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CONTENTS.

Editorials 1519
Scope of the N. E. L. A. 1522
Electric Vehicle Banquet in Boston 1522
New York Jovian Luncheon Club 1523
Regulations Regarding New Code Rubber-Covered Wire 1523
Central-Station Activity in the Electric-Vehicle Field 1523
Electric Vehicle Meeting at Lynn, Mass. 1524
Lighting the Panama Canal 1525
Inauguration of White Way in New Haven 1525
Panama Canal Hydroelectric Plant at Gatun 1525
Hydroelectric Development on the Clackamas River 1526
Cleveland Central-Station Situation 1526
Public Utilities and Progress 1526
Apparatus for Artificial Respiration 1528
Turin International Electrical Congress 1529
Committee on Gas and Electric Schedules in New York State 1531
System of Accounts in New Jersey 1532
Treatment of Depreciation in New York Accounts 1533
Important Hydroelectric Power Decision by Massachusetts Public Service Commission 1533
Public Service Commission News 1534
Current News and Notes 1535
Calgary Hydroelectric Plant 1539
Delray Station Detroit Edison Company.—II. 1542
Milwaukee City Garbage Electrical Plant 1545
The Largest Central-Station Turbine in New England 1546
The Generating and Transmission System of the Telluride Power Company.—V. 1547
Experiments with Electrification During Growth of Garden and Greenhouse Plants 1549
The Pabst Theatre, Milwaukee 1553
The Effect of Frosted Lamp Tips on Light Distribution. By Albert Scheible 1555
LETTERS TO THE EDITOR:
Lamp and Reflector Cleaning in Machine Shops. By C. E. Clewell 1555
Heavy Feeder Construction. By C. E. D. Egerton 1555
Digest of Current Electrical Literature 1556
Book Reviews 1559
New Apparatus and Appliances 1560
Industrial News 1565
General News 1569
Weekly Record of Electrical Patents 1575

TRANSMISSION PLANT WITH ALUMINUM CONDUCTORS.

The Canadian Northwest is rich in waterfalls which need only a market to become valuable sources of power. This market has, as our readers know, been rapidly building up during the past few years with the phenomenal growth of population and enterprise in that part of our continent. The plant described elsewhere in our columns is particularly for the purpose of supplying the city of Calgary, although an auxiliary market has been found in Exshaw. The source of power is at Horseshoe Falls, about 50 miles from Calgary, where a head of 73 ft. has been made available. The present installation aggregates 9000 kw in three units, with space for an additional 4000-kw unit when it becomes necessary. Oddly enough, two types and sizes of generators are employed in this comparatively small plant and coupled each to a different type of turbine —a complication which on the face of things seems unnecessary.

Nothing specially out of the ordinary is embodied in the station equipment, which is worked out on the usual lines of remote control from a desk in the gallery overlooking the generator-room. The generating units themselves are of 12,000 volts for local service and the transmission to Exshaw, while for the long line leading to Calgary the voltage is raised to 55,000. The main transmission line is of very simple and economical construction, consisting of 40-ft. cedar poles. On the tops of these is carried a grounded steel cable on small insulators. The three-phase circuit is carried on two cross-arms, the lower an ordinary double arm, the upper an arm extending on one side of the pole only, so that the wires are arranged in a right-angled triangle. The spacing, vertical and horizontal, between wires is 5 ft. 6 in., and the insulators are of the large triple-petticoat variety usual for such a voltage. Seven feet below the lower conductors is a small cross-arm carrying a telephone circuit. A duplicate line to Calgary running most of the way over an entirely different route is now under insulation. Every tenth pole is double-armed and guyed. The poles are spaced forty to the mile, and the construction is certainly one both cheap and effective for a case where independent circuits are desired and the country is relatively clear. The line wires are No. 0 equivalent aluminum cable.

The aluminum-conductor feature, considering the severity of the climate, is of exceptional interest. With proper allowance for sag an entirely adequate factor of safety can be given to an aluminum line, and it is a constant source of wonder to many that aluminum is not more freely used in the United States. It has been exploited for line-wire purposes for some years past and has in practice proved economical and successful, yet it is only now and

then employed in this country, though largely used abroad. It would be interesting to know, if it were possible, the exact conditions which exist respecting the commercial side of its exploitation. There seems no doubt whatever that at foreign prices for aluminum it can compete with copper with a very considerable margin of profit. There is a rather heavy duty of 7 cents a pound—equivalent to about 50 per cent—on aluminum imported into the United States and, as is usual in the case of articles carrying considerable duty, the American price is regulated by the duty-paid price of the foreign article. Aluminum in this country is quoted at practically 7 cents a pound higher than the London figure, plus a small allowance of, say, 1 cent a pound to offset a sufficient portion of the transportation charges to make importation unprofitable. The American makers of aluminum do not seem to cultivate the manufacture of wire in a way that would introduce active competition with copper. Whether this arises entirely from the growing use of aluminum for other purposes or is due to some community of interest with those who control the copper situation is at the present time a matter of conjecture.

The known fact in the case is that the price of aluminum is kept just at a point where the extra trouble in erection to meet the existing climatic conditions is sufficient to make the engineer think twice before abandoning copper. Indubitably also the somewhat general use of tower construction with its long spans, for which hard-drawn copper is commonly used, has an influence on the situation. It would be interesting, however, to know the cost of the Calgary line per mile as compared with the ordinary practice on this side of the border. Some day the duty on aluminum is likely to be considerably reduced, and the economics of line construction will then be very suddenly altered.

ELECTRIC PUMPING FOR CITY WATER SUPPLY.

The feasibility of electric pumping for water-works of small cities is too well established to make argument necessary. The pumping costs of the average small water-works are so high that it is an easy matter to make a profitable rate for electric pumping considerably below the previous pumping costs. However, the larger the water-works plant the more difficult becomes the problem of securing this business for electric pumping at a profit. One speaker at the recent Illinois convention advanced the opinion that electrical operation of water-works should be undertaken by central-station companies at little or no profit, if necessary, because the existence of a steam-operated water-works is a constant temptation to the city to put in a plant for electric lighting as well. Such a course could probably only be justified before a public-service commission by the argument that such low rates were made to the city as a compensation for the franchise.

In the case of the majority of small cities the taking of such pumping business at no profit would be an altogether unnecessary proceeding, for the reason that in such cases there is usually no difficulty in saving considerable money for the city and at the same time making the rate profitable to the electric-service company. From the engineering standpoint and the financial standpoint as well, the greatest obstacle to be overcome when introducing electric pumping for water-works in small cities is that of providing for extra pressure and increased rate of pumping during fires. The provision of sufficient pump capacity for ordinary service requirements involves comparatively small cost. In most small cities, however, the pressure during fires must be maintained at approximately double the regular service pressure, coupled with a rate of pumping from three to five times the ordinary service requirements. Motor-driven pumps for such service are the most expensive items in connection with a change to electric pumping. If the attempt is made to get around this by maintaining steam pressure at the water-works plant for emergencies, the cost of banking the fires is likely to wipe out the difference between electric and steam pumping if the labor is figured in.

Some discussion also took place at the Illinois convention as to the relative advantage of taking city pumping contracts on the basis of kilowatt-hours on the one hand and per million gallons pumped on the other hand. Propositions based on million gallons pumped have the obvious advantage at the outset that the city officials frequently do not know the relation that is likely to exist between kilowatt-hours and million gallons pumped, and are more likely to be suspicious of a kilowatt-hour proposition; while, if the company supplying the electricity does not have control of the pumping apparatus and water supply, either deterioration of the apparatus or increased lift of water made necessary by changed conditions may wipe out all the profit of the undertaking. Furthermore, the meters necessary for water measurement will cost many times as much as the electric meters. Either the kilowatt-hour or million-gallon form of contract should be satisfactory if proper safeguards are provided. The possibility of changed pumping and water conditions, however, should be kept in mind when such contracts are drawn, and any loss caused by defective maintenance of apparatus should fall upon whichever party is responsible for such maintenance.

LAMPS OF LUMINESCENT NEON VAPOR.

It is well recognized that there is a better chance to develop a highly efficient incandescent electric lamp with a column of vapor than with a solid filament. This is for the reason that there is only one known way of making a solid filament give out light, and that is by heating it to the incandescent temperature. There is no known way of keeping a substance at the temperature of incandescence without radiating from the substance a relatively large amount of dark heat or non-luminous radiant energy. On the other hand, a gas can be made luminescent in such a way that it radiates energy selectively, and perhaps entirely in luminous form. In other words, the spectrum of a white-hot solid is a continuous spectrum all the way from the high frequencies, in the treble which the eye perceives, down to the deep bass of low-temperature radiation, and the treble notes cannot be held down without holding down the entire keyboard along with them; whereas a luminescent gas radiates in a certain line spectrum or band spec-

trum only, so that the treble frequencies sought for may be obtained without any wasteful and unnecessary bass accompaniment. In an article published recently in *La Revue Electrique,* as noted recently in the *Digest,* M. Blondin describes some recent developments of neon-vapor lamps, as made by M. Claude in France. A preferred size of such a lamp appears to be a tube about 6 m long and 45 mm in diameter, operating at an alternating terminal emf of about 1000 volts. It is claimed that these neon lamps can operate for 800 hours at a specific consumption of 0.8 watt per candle at primary terminals of the special step-up transformer. At lamp terminals this would be about 0.75 watt per candle. It is not clear, however, from the description whether reference is made to a cylindrical or to a spherical candle; so that, although the specific consumption is evidently very low, it is not certain just how it compares with that of other lamps. Many difficulties have had to be met in producing a neon-vapor lamp, and this low specific consumption is thereby the more remarkable.

THE DIELECTRIC STRENGTH OF CABLES.

The atmosphere in which we live is not only the universal store of oxygen, from which all living animals draw their stock of combustion energy, but it is also the great electric insulating medium, in which all organisms are enveloped. The influences of the atmosphere on organic life are hardly less important from the standpoint of a universal insulating medium than from that of a universal fuel storehouse. In electrical engineering there is no insulating substance so inexpensive, so convenient and so easily applied as air, notwithstanding the fact that its dielectric strength is relatively low. So lavishly does our environment offer insulating facilities for aerial wires that not until we are compelled to place wires underground do we realize how much it costs to replace air insulation by solid insulation of any kind in buried cables. The actual necessity of employing high electric stresses in cables and the commercial necessity of employing the least total amount of insulating material consistent with safety have led in recent years to a study of the laws of electric flux in cable insulation. The fundamental fact is that the stress upon a cable-insulating sheath, tending to rupture it electrically, depends upon the electric flux-density. In its turn the electric flux-density depends upon the nature of the material and upon the gradient of the electrical potential. If we confine attention to one and the same uniform insulating material, such as rubber, the dielectric strength of the insulating layer does not primarily depend upon the electric potential imposed on the layer, but on the rapidity of change of that potential in neighboring space. If the electric potential impressed upon the insulating layer were the same throughout the layer, so that there was no change in potential, then the electric flux-density would disappear, and there would be no break-down stress upon the layer, no matter how high the potential might be. On the other hand, a low electric potential or voltage applied to the conductor of a cable can produce a high break-down stress on the insulator if the gradient of potential in the insulator is rapid; that is, if within a little distance, of say 1 mm, the potential falls by many kilovolts, the electric flux-density being proportional to this potential gradient.

Between a pair of parallel metallic plates a layer of uniform insulating material necessarily develops a uniform gradient of potential at all points. For example, if a flat sheet of fiber 0.5 cm thick is clamped between a pair of parallel opposing metallic plates connected to a difference of potential of, say, 15 kilovolts, then, except near the edges of the plates, the gradient of potential in the sheet will everywhere be uniform at 30 kilovolts per centimeter, with a correspondingly uniform electric flux-density and intensity of break-down stress. But when the insulating sheet, instead of being flat, is bent or curved between correspondingly curved metallic conducting surfaces, the gradient of potential and the electric flux-density are always greater at the surface of greater curvature; so that the tendency to break down electrically is always greater at or near the surface of greater curvature. For the same reason, when a single round wire is placed at the center of a round leaden sheath and insulated by a uniform cylindrical coating, say, of varnished paper, the insulating layer has a greater curvature at its inner surface of contact with the central wire than at its outer surface of contact with the sheath; consequently, the gradient of potential, the electric flux-density and the break-down stress are all greater at the inside than at the outside layers, and if the insulating material is homogeneous it will always tend to break down first on the inside. Experiment amply confirms this generalization. The smaller the diameter of the central wire the greater the curvature of the inside layer of insulator and the more intense the break-down stress on that inside layer for a given potential impressed on the wire. High-potential cables, therefore, avoid the use of thin single-wire conductors.

The question arises as to what is the effect of stranding a conductor upon the break-down stress at the inside insulating layer, where that stress is sure to be the greatest. Mathematically speaking the question is, How is the potential distributed near to and outside of such a stranded conductor? If the potential distribution can be determined for any given set of cable dimensions, the gradient of potential and the break-down stress can be determined. Professor Levi-Civita first solved this problem mathematically, and Mr. E. Jona was the first electrical engineer to apply and check the mathematical formula experimentally. In general, the result is that the potential gradient is always steeper near the outside of a stranded wire than near the outside of a corresponding cylindrical conductor, so that the dielectric strength of a cable of given dimensions is always reduced somewhat by stranding the wires. In fact, some high-tension cables have been made with a thin leaden sheath over the stranded conductor, so as to cylindrize the conducting surface. In our *Digest* last week reference was made to an article by Herr W. Deutsch, appearing in a recent number of the *Elektrotechnische Zeitschrift,* on this subject. The paper indicates that in general the use of a stranded conductor, concentric with a leaden sheath, increases the potential gradient nearly 30 per cent with respect to a single cylindrical central conductor of the same diameter.

Scope of the National Electric Light Association.

Mr. John F. Gilchrist, president of the National Electric Light Association, addressed the Electric Club of Chicago on Dec. 13, taking as his subject the work of the National Electric Light Association. In an interesting talk Mr. Gilchrist remarked that the membership of the association has now passed the 10,000 mark, and that there are over 8000 Class B members; that is, employees of member companies. The speaker made a calculation to show that probably between 500,000 and 1,000,000 persons are interested in the electric central-station industry in the United States, either directly as employees of operating companies or as manufacturers, dealers or agents supplying apparatus to such companies. A similar computation in relation to street-railway, telegraph and telephone companies would swell the number to a very much larger extent, and, when the families of these persons are considered also, it will be seen that a respectable proportion of the inhabitants of the United States are in some way related to the electrical industry. An increasing number of people are coming into the industry, with its growth and development. The development of low-head water-powers and of water-powers available only a part of the year was spoken of as one avenue in which the industry would undoubtedly expand in the future.

Mr. Gilchrist believes in the sectionalizing tendency in the association and said that he thought there might be a section for electric vehicles and one relating to illuminating engineering. An effort should be made also to effect co-operation between the N. E. L. A. and the various electric clubs scattered throughout the country and perhaps with other electrical organizations. Interest and enthusiasm for the work of the association are now running high, and apparently there is no reason why the membership may not grow to 50,000 or 100,000. The American Medical Association, with its affiliated class of members, has a total membership of about 75,000. There seems to be no reason why the distinctive general society of the electrical industry should not become correspondingly strong and powerful. Mr. Gilchrist believes that the name of the society might well be changed to National Electric Association and that the organization should reach out and cover the entire industry. (It is interesting to note that President Gilchrist's advocacy of a change in name to the National Electric Association is in line with an editorial on the same subject which was printed in the *Electrical World* of May 25, 1911.)

Mr. H. H. Cudmore, of Cleveland, spoke of the work of the Electric League of that city. He said that under the auspices of that organization three pages of co-operative daily-newspaper advertising are now printed weekly. The success of the Cleveland club has been due to individual effort on the part of members. The speaker believed that some sort of co-operation might be arranged between the various electric clubs and the N. E. L. A.

Mr. Harry C. Rice, of Cleveland, made a little speech on co-operation and optimism. On the first subject he advised his hearers to get Maeterlinck's "Life of the Bee" as a book from which they could learn much on practical co-operation. On the second phase of his subject he asked the pertinent question, apropos of wailing about the economic tendency of the times, "Why blow out the candle to find out how dark it is?"

Mr. E. W. Bemis, formerly of Cleveland, who has been retained by a number of municipalities as expert adviser on public-utility questions, said that several years ago he favored municipal ownership of public utilities in many cases. He is now engaged in rate-regulation work, however, and it is curious to reflect that, so far as his work is successful in establishing equitable rates, he is himself helping to postpone the day of municipal ownership of public utilities.

Electric-Vehicle Banquet in Boston.

A rousing climax to the 1911 electric-vehicle campaign in New England was celebrated by the Electric Vehicle Club of Boston on the evening of Dec. 19, when a banquet was given at the Boston City Club to about 200 members and guests, including many prominent federal, State and city officials, merchants, educators and men of high standing in electrical circles. The object of the banquet primarily was to bring home to the guests of the club the remarkable progress of the electric vehicle within recent years, and to emphasize its great adaptability, flexibility and economy within the field of urban and suburban transportation. The gathering was the most enthusiastic in the history of the electric vehicle in New England, and the key to the discussion was furnished by the principal speaker, Mr. Hayden Eames, of Cleveland, Ohio, who declared that only the inherent conservatism and dislike of change common to the human race now stand in the way of one of the greatest triumphs electricity has ever been prepared to win.

President Day Baker, of the Boston Electric Vehicle Club, called the assemblage to order at the close of the banquet with a short address of welcome, introducing President W. H. Blood, Jr., of the Electric Vehicle Association of America, as chairman of the evening. Mr. Blood emphasized the practicability of the electric vehicle as contrasted with its status in its earlier days. He pointed out the great economic waste of horse traction as illustrated in the heated term of the past summer, when 3752 horses, having a total value of over $1,000,000, succumbed to the weather; touched upon the unanimity of brewers regarding the cash value of the electric truck in New York, and sketched the efficient application of the commercial machine to department-store and central-station requirements.

Telegrams of congratulation were read from Messrs. L. A. Ferguson, Chicago; Frank A. Frueauff, Denver, Col.; Herbert A. Lloyd, Philadelphia; Rausch & Lang, Cleveland, Ohio; E. C. Vickar, St. Louis, Mo.; R. B. Daggett, president Pacific Coast Electric Vehicle Association; Robert M. Searles and James T. Hutchings, Rochester, N. Y., and Harvey T. Robinson, New York. Great enthusiasm was aroused by the following special-delivery letter from Mr. Thomas A. Edison.

"To you, members of the Electric Vehicle Club of Boston, and your guests assembling, I send greetings. The educational work you are doing cannot fail to convince finally the great public that the universal power will be given out by electric motors. Already cotton mills, machine shops, iron works, mines, street cars, steam roads and all are going electric. Vehicle transportation in cities and suburbs will ultimately be done by electric storage-battery vehicles. There is no escape from the fact that an electric motor has but one moving part, and that rotating, whereas all other motors have hundreds of parts, mostly reciprocating."

The toastmaster of the evening, Mr. La Rue Vredenburgh, of the Boston Edison Company, called upon Major H. F. Crowley, of the Governor's staff, for a brief salutation and then introduced Mr. Hayden Eames, who delivered an address upon "The Electric Vehicle for City and State." He reviewed the development of motor transportation in Europe, emphasizing the influence of good roads and high freight rates upon the progress of the industry. The steam-motor haulage of goods in England from the railroad into the surrounding districts had been successfully based upon a cost of 3 cents per ton-mile. The day is almost at hand in this country when the strength of bridges and the character of roads will have to be improved to permit the passage of much larger trucks than are now in use. Mr. Eames said that the United States government is well in advance of European governments in the development of military automobile applications. Turning to the electric machine, the speaker pointed out the great importance of detachable mechanism and fittings. He contended that the

gasoline car meets the demands of interurban service and that the urban field belongs to the electric truck and pleasure vehicle. For city transportation the horse has been at a disadvantage for ten years. Even the earlier storage battery was a better chemical appliance than the horse. Proper installation and operation are vital to the success of the motor-wagon. The electric truck means decreased labor and maintenance charges in competition with gasoline, although the latter is more mobile and speedy where long distances are involved. An increase in the size of trucks means a saving in wages per unit of merchandise handled. Ten-ton trucks are likely to be in use within two years. About $10,000,000 worth of electric trucks have been purchased thus far in this country, about one-fourth of this sum having been expended in the past year. It is estimated that sixteen times as much freight is handled on wagons and trucks as on railroads, and that in Boston alone 76,500 kw-hours would be daily required merely to convey retail freight away from the terminals to the receiving warehouses. The electric vehicle is no heavier for the required service than is the gasoline truck.

Mr. Eames dwelt at length upon the value of synthetizing the costs in selling electric vehicles and contended that wide experience enables the expense of such service to be determined with high accuracy in advance of the installation. He presented the following broad figures of electric truck economy:

	Packing House.	Packing House.	Department. Store.	Department Store.
Electric investment	$166,000	$36,000	$83,000	$51,000
Horse investment	94,000	26,000	36,000	21,000
Yearly saving by electrics	23,600	15,000	20,000	11,000

In closing he pointed out that the maintenance of the modern electric truck is sometimes only 50 per cent of the allowed total, and prophesied that the inertia of the human race will soon be absolutely unable longer to stem the tide of electric vehicle advance.

New York Jovian Luncheon Club.

At the second meeting of the New York Jovian Luncheon Club, which was held Wednesday, Dec. 13, at Kalil's Restaurant, 18 Park Place, the attendance numbered 137, the attendance at the first meeting having been 104. Mr. C. A. S. Howlett, of the General Electric Company, of Schenectady, was the speaker of the day.

Mr. Howlett, after complimenting the chairman of the meeting, Mr. F. E. Watts, on his enthusiasm and industry in his work in connection with the organization, spoke forcibly on the necessity of such an organization having some work of a practical nature to do in order to bind it more firmly together. He used as an illustration the organization of the first luncheon club in Chicago, showing that, while the first meetings were of benefit from the co-operative "come together" spirit which was engendered among the members, the fact that there was nothing practical to do led in a short time to the dissolution of the organization. He contrasted this with the great success of the present Electrical Club of Chicago, composed of exactly the same class of men as those in the former organization. The fact that it had been in existence now for several years and that it was successful and had a constantly growing enthusiastic membership of practically all the live wide-awake electrical men in the city of Chicago was, in his opinion, due entirely to the fact that the Electrical Club of Chicago was doing things of a practical and definite nature. At each one of its meetings, which are held weekly, there is always one speaker who has something to say of interest to the electrical men of Chicago, something which the Chicago men should know about, should discuss among themselves and work together on, either for or against.

The next meeting is to be held Wednesday, Dec. 27, at Kalil's Restaurant, when there will be a Jovian rejuvenation. While the organization is composed at present of Jovians, the plan is not to limit the luncheon club to members of the order, but to invite and welcome to each luncheon all who are interested in any way in the development of the electrical industry.

Regulations Regarding New Code Rubber-Covered Wire.

Beginning Jan. 1, 1912, the rubber-covered wire specifications promulgated by the National Fire Protection Association at its meeting last March become effective. No wire manufactured after that date which does not meet the specifications as printed in the 1911 edition of the National Electrical Code will bear the stamp of approval of the Underwriters' Laboratories, except that representing bona fide stock or contracts placed or taken prior to Jan. 1, 1912. The old Code wire represented by the latter will not bear the new label, and contractors, dealers, etc., will have until July 1, 1912, to dispose of such stock or to fulfil such contracts. After that date, however, no old Code rubber-insulated wire will be approved at all.

After Jan. 1, 1912, there will be a single label factory inspection service, this service representing a merger of the Wire Inspection Bureau service on National Electrical Code rubber-covered wire with that of the Underwriters' Laboratories and being under the direct operating control of the latter organization. This inspection will not only be thorough at the factory but will also comprise a rigid follow-up system in the field.

Central-Station Activity in the Electric-Vehicle Field.

At the meeting of the Electric Vehicle Association of America in New York, Dec. 19, Mr. Stephen G. Thompson, of the Public Service Electric Company, Newark, N. J., presented a paper which reflected to a marked degree the activity of the central-station industry in the electric-vehicle field. The author stated that approximately 40 per cent of the estimated total of 5000 electric commercial vehicles at present in use are employed in some forty-odd installations, indicating a tendency on the part of the manufacturer to concentrate his efforts in the larger cities and on a few customers, thereby neglecting the less thickly populated territories. The gasoline commercial vehicle manufacturers have cultivated this neglected field, with the result that in the past year they marketed 200 per cent more machines than did the electric-vehicle makers since their first entry into the market, this fact being due not to any particular superiority of the machines themselves, but to the energy of the vehicle salesmen and agents. It is because of its faith in the ultimate triumph of the electric vehicle that the central-station industry is justified in actively promoting this type of vehicle, in the same manner that it has promoted the introduction of other energy-consuming devices; and did its activity meet with an equivalent co-operation on the part of vehicle manufacturers an unprecedented electric-vehicle boom would result.

Although Mr. Thompson contends that the argument that central stations should themselves operate electric machines in order to demonstrate their faith in them is not of itself a

legitimate one, unless their application in the transportation department is attended by economies sufficient to offset the increased investment over horse-drawn vehicles, the enormous investments by central stations in electric vehicles emphasize their appreciation of the economic value of the commercial machines.

The establishment of boosting stations, the author felt, might ultimately come within the scope of central-station activity, but the question of whether the central station should maintain public garages is a moot one. Where the number of vehicles is so small as to make the employment of a competent battery man unwarranted in a garage, Mr. Thompson felt it would be justifiable for the local lighting company to subsidize such garages until such time as the vehicle manufacturers themselves shall have placed enough machines in the territory to warrant their operating their own garages.

As indicative of the results to be expected from the establishment of garages by central stations, the author cited the case of the Union Electric Light & Power Company, of St. Louis. In that city the number of vehicles in use increased from eleven, in 1907, to over 450, because of the company's fostering care. The number of public electric garages in St. Louis has increased 62.5 per cent since October, 1910, and there are at present over sixteen commercial garages.

In view of the expenditures of central-station companies for promoting the use of electric vehicles, the sums invested in machines, the reductions made in rates, the establishment of boosting stations, garages, inspection departments and automobile bureaus, Mr. Thompson feels that the manufacturers themselves will soon be hard pressed to care for the business which the central stations are developing. Correspondence has disclosed that, in the main, central stations have emphatically decided that their activity in the electric-vehicle field has been justified, and the increase in the number of vehicles used is sufficient to warrant the belief that continued co-operation will produce a demand far in excess of the ability of the manufacturers to supply it. The author closed with the prophecy that the time is not far distant when the general use of the electric vehicle may be expected to tax to the limit existing central-station installations, in spite of the fact that this particular demand for energy is essentially off-peak.

Discussion.

The paper was discussed by Messrs. Arthur Williams, Frank W. Smith, N. T. Wilcox, W. E. Curtis, Jr., P. S. Young, J. Richards, R. L. Lloyd, F. B. Neely, E. J. Ross, Jr., W. B. Stoughton, T. I. Jones, F. E. Queeney, E. L. Howland and S. S. Phillips.

The consensus of opinion was that the central station has been very liberal in the expenditure of money, time and facilities upon the electric vehicle, and this in spite of the fact that actual returns from established garages were not sufficient to cover the cost of service and interest on the investment in very many instances.

Mr. Wilcox said that his company expected to have nothing but electric vehicles in Lowell and also in Brockton by 1913. Mr. Young said that the Public Service Electric Company, of Newark, would eventually have from 50 to 100 electrics, using these in preference to all other types. His company will devote a portion of its old office building for exhibition purposes of electric machines of various types. Both Mr. Young and Mr. Wilcox spoke of the difficulty of convincing electric operating men and superintendents of the utility of the electric vehicle for their work.

Mr. Jones told of the visionary claims of early manufacturers of electric pleasure cars, and how their unfilled promises have militated against the introduction of electric pleasure vehicles in Brooklyn, stating that there are at present eighty-three inoperative old electric vehicles whose owners, owing to past experience, would not entertain propositions for the modern electric vehicle at any cost. The decorative tungsten street posts in front of his company's branch offices are equipped for charging electric vehicles, and all of the tungsten street posts now being installed are designed so that each may become a charging station eventually. He commented on the dearth of reliable operating data showing the superiority of the electric over the gasoline and horse-drawn vehicles.

Mr. Stoughton suggested that manufacturers have apprenticeship courses, somewhat similar to those of the large electric manufacturing companies, where high-school graduates and others could receive a shop training and be sent out to operate machines.

Mr. Howland spoke on the general subject of publicity and the desirability of co-ordinating all the various branches of the industry. The electric-vehicle people, he maintained, do not make enough noise and do not advertise the excellent qualities of the electric vehicle, especially for commercial work. This field, which was entirely in the hands of the manufacturers of electric vehicles, is fast being entered by manufacturers of gasoline commercial cars, who now build self-starting attachments and attempt to make their machines fool-proof. He maintained that manufacturers lacked a broad-minded spirit, and that what was needed was a campaign for educating the public to know what the electric vehicle can do. In this respect, he said, the central-station industry was more energetic than the manufacturers of vehicles and of storage batteries, but the best results could only be obtained when all three could forget their individual fields and concentrate their efforts toward securing for the electric vehicle that wide adoption which was its due.

The secretary announced that the membership of the association at the present time was 233.

Electric Vehicle Meeting at Lynn, Mass.

By invitation of the General Electric Company a meeting of the New England Section of the Electric Vehicle Association of America was held at Lynn, Mass., in the company's River Works, on the evening of Dec. 14. A large party assembled at Park Square, Boston, late in the afternoon, and made the run of about 15 miles over the Metropolitan Parkway to the center of Lynn in about one and a quarter hours, all the transportation being by electric pleasure vehicles under the direction of a committee headed by Mr. P. E. Whiting, of S. R. Bailey & Company, Boston. Upon reaching Lynn a parade took place through the business district, after which the party steered for the River Works. Mr. Fred M. Kimball, manager of the small-motor department, and Mr. H. S. Baldwin, factory engineer, acted as hosts, and shortly after the arrival of the party a luncheon was served in the works restaurant. Brief addresses emphasizing the bright future of the electric vehicle were made by President E. S. Mansfield, of the New England Section; Day Baker, president of the Boston Electric Vehicle Club; Prof. Dugald C. Jackson, of the Massachusetts Institute of Technology; Mr. W. H. Francis, purchasing agent of the Boston Edison Company; Prof. Elihu Thomson, Mr. Frank J. Stone, Boston, chairman of the membership commitee of the Electric Vehicle Association; Mr. W. B. Potter, chief engineer of the railway department of the General Electric Company, and Mr. Louis D. Gibbs, superintendent of advertising of the Boston Edison company.

Mr. Francis said that the Boston Edison company has now ordered eight electrics for passenger service, after careful investigation of the possibilities of these machines in covering a territory of about 20 miles radius from Boston. He pointed out that the lack of speed, high friction, clumsiness and extreme weight of the electric vehicles of a few years ago were largely responsible for the difficulties encountered and which seem now to be surmounted. Mr.

Stone emphasized the value of the electric-vehicle charging load to the central station during the night hours when the output curve slumps into a deep valley of relatively inefficient production. He pointed out that 100 electric pleasure cars are as valuable revenue producers as about 600 residences consuming electricity for lighting.

In the evening a technical meeting was held in the apprentice lecture-room, papers being read by Messrs. H. S. Baldwin and Alex. Churchward on the latest developments in electric-vehicle motor design. Among the recent improvements which have become well standardized are the use of high-carbon steel shafts ground within one four-thousandth of an inch; construction of armature cores on a quill; use of a cylindrical field casting and undercut commutator; employment of laminated poles with chamfered tips to reduce noise; use of copper-plated, drop-forged terminals and cast-iron resistance grids of flexible characteristics and varied size; adoption of one-piece mica cones in supporting commutators; use of graphite brushes to secure long commutator wear, and the adoption of ball bearings, which saves space and improves the efficiency of lubrication. By the oil treatment of shafts twice the former elastic limit is being secured. The use of the one-piece magnet frame has done much to simplify the question of appearance, cost, quick delivery and adaptability for meeting varied specifications. Aluminum heads are being used on vehicle motor frames in some cases, these being simple in design, a disk shape being provided to carry the bearing pocket. Four-pole motors are now general, and the use of formed coils and rectangular wire has been continued. Special attention has also been given to the simplification of controller details, and an important improvement has been effected in the use of transition points in passing through the various series-parallel combinations, avoiding the breaking of the circuit under load. Vehicle motor insulation is tested at 1000 volts. The largest vehicle motor built by the company now weighs 660 lb. and is rated at 60 amp at 85 volts, its speed being 900 r.p.m. Special care is taken to secure full engineering details from the purchaser before admitting a motor to actual service. Even before bids are made, an outline of the duty proposed is required. With a properly designed motor the addition of ten stops per mile in the vehicle service cuts down the mileage which can be obtained from a given charge from 30 to 35 per cent. Following a short discussion the party adjourned to the testing floor and spent the rest of the evening making detailed examinations of equipment arranged for special inspection and test. About eighty-five persons attended the meeting.

Lighting the Panama Canal.

Work on the construction of a lighting system for the Panama Canal is under way. The scheme of illumination contemplates the use of range lights and beacons to establish direction on the longer tangents, and of side lights spaced about 1 mile apart to mark each side of the channel. The project also includes lighthouses and fog signals and lighted buoys, the latter using acetylene gas. For the beacons in the Atlantic, Pacific, Miraflores and Culebra Cut sections electricity or acetylene gas will be used. The range lights are situated on land, and it is necessary to cut clearings in dense jungle to obtain suitable locations for the lights. This work is now in progress.

A central construction plant will be established at Balboa, and here the smaller beacons, buoy sinkers, electric transmission poles and interior fittings for the towers will be constructed of reinforced concrete. The electric transmission lines required for the range lights and beacons will be installed during the year ending June, 1913. It may be explained that the beacons for use in Gatun Lake will be equipped for acetylene gas, while the remainder necessary for canal operation will be electric-lighted. The candle-power of the lights will vary, according to the length of the range, from about 2500 cp to about 15,000 cp. The most powerful lights will be those marking the sea channels at the Atlantic and Pacific entrances, which are to be visible from 12 to 18 nautical miles. The beacons and gas-buoy lights will be about 950 cp each. To eliminate the possibility of conflicting lights, all the range lights, beacons and buoys will have individual characteristics formed by combinations of flashes at certain intervals.

Inauguration of "White Way" in New Haven.

The new "White Way" of New Haven, Conn., was ushered into being with elaborate exercises on Dec. 15, accompanied by the greatest night parade ever held in the Elm City. A boulevard luminous-arc system, the first of its kind, was lighted on that night as well as a slogan sign reading "Old Elms, but New Ideas," and it is estimated that more than 100,000 people witnessed the ceremonies.

New Haven Post.

Seventy-eight inverted 6.6-amp lamps on 11.5-ft. posts similar to that shown herewith are spaced at intervals averaging 87 ft. and staggered on opposite sides of Chapel Street from State to York and of Church Street from Chapel to George. The din at the time the Mayor closed the switch which placed the lamps in circuit was akin to that on New Year's Eve, for the church bells were rung and the whistles of almost every factory were tied down in honor of the occasion.

Every militia company of the city was in the parade which followed, and nearly every line of business was represented either by representatives of the firm or by trucks, automobiles or floats, and many by quite a number of them. The New Haven Business Men's Association had more than 200 men in line, and a delegation of 100 or more from the Bridgeport Business Men's Association and Board of Trade came with bands to swell the throng. Buildings along the line of arch were decorated with bunting and vari-colored incandescent lamps.

The line of march extended over 3 miles, and the parade took an hour to pass the reviewing stand. Among the floats were many equipped by those directly interested in the installation.

The United Illuminating Company, of New Haven, had a number of floats entered, the most striking of which was one having a sample of the new post, together with a number of electric heaters and stoves. The Okonite Company, which supplied the cable, had a large reel outlined in light on an electric truck. The General Electric Company also was represented in the parade, as well as Mr. F. T. Ley, who styled himself "the man who laid the ducts." Altogether it was a gala night for New Haven.

Panama Canal Hydroelectric Plant at Gatun.

Contracts have been awarded for the principal machinery for the hydroelectric Panama Canal generating plant at Gatun. There will be three 2000-kw water-turbine units in all. From the generating station, which will be located in the center of the Gatun dam at the spillway, energy will be supplied for operating the motors controlling the gates, valves and other machinery for the canal locks, the regulat-

ing works of the spillways of Gatun and Miraflores dams, as well as other motors and electric lighting along the canal. Water for the operation of the plant will be taken from Gatun Lake at a head estimated at 75 ft. From a concrete forebay in the spillway dam water will be carried in penstocks, equipped with headgates and regulators, to the turbines. The amount of water available for station operation when the storage of the lake has to be drawn upon during the dry season will be 275 cu. ft. per second, which is equivalent to about 1390 kw at the switchboard.

The turbine waterwheels will be of the single-runner, scroll-case, vertical-shaft type, turning at 250 r.p.m. Final delivery is promised within five months. The three main generators are to be directly coupled to the vertical turbine shaft, the bearings for the rotating parts being placed on the top of the generator case. Final delivery of the generators is promised in 200 days.

Hydroelectric Development on the Clackamas River.

The Portland (Ore.) Railway, Light & Power Company has been making extensive additions to its hydroelectric system, and has just placed in operation a new plant on the Clackamas River at River Mill near Estacada. The dam is 686 ft. in length, 80 ft. high and 150 ft. wide at the base. It is of the Ambursen type, with its sloping face on the upstream side to permit the water to exert a downward pressure on the foundation. The structure is hollow and is provided throughout its entire length with passageways, which afford convenient access to the interior. The generating station is built directly in connection with the dam. It occupies a ground area of 173 ft. by 60 ft., and is of sufficient size for housing five 3300-kw generating units, three of which have already been installed.

Between the River Mill plant and Portland the company has constructed a transmission line 28 miles in length, carried on steel towers, of which 316 are used at an average spacing of about 500 ft. The towers have a normal height of 64 ft., which is increased to 84 ft. where the line crosses other transmission systems. The towers are 12 ft. square at the bottom and about 3 ft. square at the first cross-arm. The main legs of the towers are composed of angle irons, and the cross-arms of two channels. The arms are spaced 6 ft. apart in the vertical plane. At one point where the line crosses the Willamette River and a span of 1800 ft. is necessary use is made of specially designed towers. The tower on the east bank of the river is 100 ft. high and the one on the other bank 85 ft. high, the piers of both being set in concrete. These extra high towers bring the transmission wires about 75 ft. above the mean low-water level of the river. The line at this point consists of three nineteen-strand No. 9 copper-clad cables with a 10-ft. spacing in the horizontal plane. The maximum pull at the top of each of these two towers is about 42,000 lb.

The weight of the standard towers is about 4000 lb., and they were assembled at the spot and set 7 ft. in the earth with a special foundation shoe. It was not necessary to use concrete foundations, the legs being merely run down the required distance in the natural clay soil. The strength of these towers is as follows: Horizontal pull, 12,500 lb., taken parallel to or at right angles with the line, with the load at the ends of any of the cross-arms; horizontal pull applied at the ends of any of the cross-arms, 4000 lb.; horizontal pull in the direction of the line, with the load applied at the ends of any of the cross-arms, 6000 lb.; vertical load applied at the ends of any of the cross-arms, 1500 lb. The towers cost $150 apiece delivered on the spot. They are equipped with Ohio Brass Company's suspension insulators, placed three in series for the line conductors and four in series for the strain. The towers are arranged for two circuits with a grounded wire on the top, and they also carry a telephone circuit. The conductor wires are 250,000-circ. mil hard-drawn copper cables, and the ground wire is of ⅜-in. extra galvanized iron. The entire line will cost approximately $160,000.

Cleveland Central-Station Situation.

At a banquet last week Mayor-elect Newton D. Baker of Cleveland, Ohio, made the assertion that within two years the city will own electric plants which will be furnishing the homes with energy at something like, if not something under, 3 cents per kw-hour. He said that he had been studying the question with lighting experts and that his knowledge was now much broader than before the election, when he could not make promises so definite. He also attacked the bond dealers of the country and said that they had in the past refused to purchase bonds that were sold to secure funds for municipally owned plants of this kind. If the bondmen do not want the $2,000,000 of securities that are to furnish the money for the lighting plant, he said these would be sold in small lots to the people, who would then not only receive the benefits of reduced rates, but would own the plant.

In an interview Vice-President Samuel Scovil of the Cleveland Electric Illuminating Company said that the Mayor-elect is already hedging. Before the election, he said, Mr. Baker made the positive assertion that his proposed municipal plant would furnish energy at 3 cents, but now he has changed his promise to "something like 3 cents." He will hedge again before he is able to put his promises into execution, Mr. Scovil said.

Mr. Scovil said that his company is not going to stop growing merely because the city threatens to put in a two-million-dollar plant. A year ago $1,300,000 stock and $1,000,000 bonds were sold to secure funds for needed extension, he said, and next year $3,000,000 more would be needed for the same purpose, and to that end a request for authority to issue stock and bonds has been made to the Public Service Commission. Additions must be made to the Lake Shore plant, he said, and money must be spent for underground and overhead work in order to accommodate the demand for service.

Councilman F. S. Haserodt has suggested that the property of the Cleveland Electric Illuminating Company be purchased by the city at once. He says that the $2,000,000 from the bond issue may be applied as a payment down and a mortgage given for the remainder. Stockholders could be guaranteed a certain income upon their holdings until payment in full is made. The city would thus have the advantage of the large plant at once, with the reduced rates that the coming administration expects to give arbitrarily.

Public Utilities and Progress.

The Commonwealth Edison Section of the National Electric Light Association, Chicago, met at Handel Hall Dec. 5 to hear an address by Mr. H. M. Byllesby on "Public Utilities and Progress." The meeting was called to order by the new president of the section, Mr. R. F. Schuchardt, who made a brief address announcing plans for the section for the coming year. The commercial division will be under the direction of Mr. O. R. Hoge and the technical division under Mr. P. B. Juhnke. A competition among the members of the section was announced for the prize of a free trip to the Seattle convention of the association. Markings for this competition are to be based on a number of things, such as performance of duty, attendance at meetings, etc., and are to be announced in the next issue of the *Edison Round Table*. The membership committee announced 164 applications for membership received during November, 1911, a large increase over November, 1910.

After music by a quartet which alluded both in a graceful and an amusing way to the speaker of the evening, Mr. Byllesby, President Schuchardt called upon Mr. Samuel Insull to introduce the speaker of the evening because of his lifelong business acquaintance with Mr. Byllesby, both having been in at the beginnings of the electric-lighting industry. In his introduction Mr. Insull mentioned the interesting coincidence that Mr. Byllesby, prominent in electrical finance in Chicago, and Mr. Frederick Sargent, equally prominent in engineering and the designer of Chicago's greatest power plants, successively filled the same positions when they started in the electrical business. When Mr. Byllesby left a position as draftsman for the Wetherell Corliss Engine Works Mr. Sargent was his successor, and when Mr. Byllesby left his next position with the Edison Illuminating Company Mr. Sargent again was his successor.

Mr. Byllesby in his address on "Public Utilities and Progress" recalled some of the advances made in the thirty years that he had been connected with the electric public-utility business. These advances of themselves were sufficient evidence of the remarkably progressive character of the men engaged in the business. He made the assertion that no greater progress has been known within a short time than that in the electrical business, and that men of the most progressive character are engaged in this business. Not only are the utility companies in themselves progressive, but they have had a decided influence in waking up the communities in which they conduct their business. Time and again he had seen progressive, up-to-date management of a public-utility property replace former indifferent, incompetent management, with a result that influenced the whole business character of the community. In fact, no single concern in a community like Chicago does as much business in dollars and cents as the public utilities, with the possible exception of the tax collectors. The influence of electric public-utility management and the progressiveness of its men have been felt by other industries. The gas business was at a standstill at the time electric light began to come into the field. Under the stimulus of competition great improvements have been made in gas apparatus and business methods. Public opinion in this country, he said, is rapidly crystallizing in the idea that a public utility should be a regulated and protected monopoly. This is the idea toward which most of the great pioneers have been working.

Appealing to his audience as composed of those responsible for conducting the business of a great public-utility corporation, he called attention to the dignity and responsibility of such positions. Great as have been the developments of the last thirty years, as he had already recited, there will be correspondingly great opportunities in the coming thirty years, with great rewards for those who measure up to the requirements.

At the close of the address President Schuchardt announced that a program of addresses by captains and leaders in public-utility work has been arranged for the coming season, including addresses by Messrs. Samuel Insull, president of the Commonwealth Edison Company; B. E. Sunny, president of the Chicago Telephone Company; B. I. Budd, president of the Chicago elevated railway companies, and Judge Peter S. Grosscup, in whose court many important public-utility cases have been decided.

German Central Stations.

The central-station statistics just published by the Verband Deutscher Elektrotechniker give exact figures on 2526 stations as to their status on April 1, 1911. It is estimated that the stations which were not heard from would swell the total number of stations in Germany to about 2700.

The development of the central stations and their connected load is shown graphically in Fig. 1. On April 1, 1911, the reporting stations had a connected load of 810,046 kw in 16,209,233 incandescent lamps; 130,175 kw in 245,772 arc lamps; 1,621,676 hp of motors, 417,897 hp of which was in street-car motors, and 73,120 kw in heating

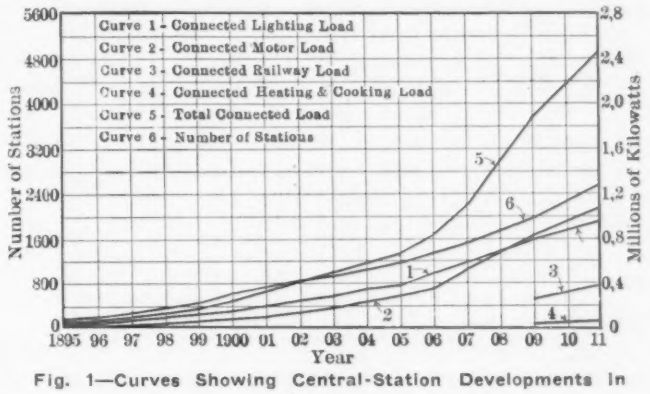
Curve 1 - Connected Lighting Load
Curve 2 - Connected Motor Load
Curve 3 - Connected Railway Load
Curve 4 - Connected Heating & Cooking Load
Curve 5 - Total Connected Load
Curve 6 - Number of Stations
Number of Stations
Millions of Kilowatts
Year
1895 96 97 98 99 1900 01 02 03 04 05 06 07 08 09 10 11

Fig. 1—Curves Showing Central-Station Developments in Germany.

and cooking apparatus, making a grand total of 2,477,849 kw.

For this connected load there is provided a total station power rating of 1,466,418 kw, of which 1,271,250 kw is furnished by generators and 195,168 kw by storage batteries. Of this total power rating 352,964 kw is in the form of direct current, 461,387 kw in the form of single and polyphase alternating current and 652,067 kw in mixed systems. The number of kilowatt-hours produced per year by 543 stations was 1,245,541,000 for 1910, against 951,033,000 for 1909, which corresponds to an increase of 15.5 per cent per year.

Classified according to kind of current the stations are divided as follows : Single-phase energy, 57, with a rating of 51,836 kw; polyphase energy, 345, with a total rating of 403,822 kw; direct-current energy, 1771, with 259,341 kw in generators and 93,723 kw in storage batteries; mixed direct-current and alternating-current systems, 353, with 556,351 kw in generators and 95,716 kw in batteries.

Classified according to type of motive power the sta-

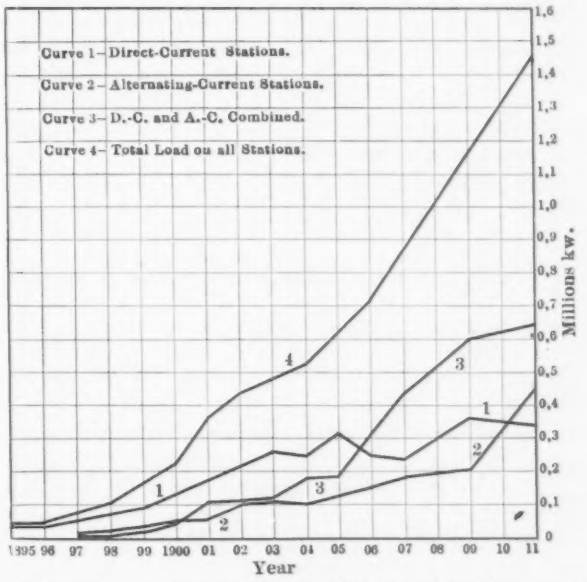
Curve 1—Direct-Current Stations.
Curve 2—Alternating-Current Stations.
Curve 3—D.-C. and A.-C. Combined.
Curve 4—Total Load on all Stations.
Millions kw.
Year
1895 96 97 98 99 1900 01 02 03 04 05 06 07 08 09 10 11

Fig. 2—Increase in Station Rating Classified According to Kind of Current.

tions are divided as follows: Steam, 799; water, 253; internal-combustion engines, 383; water and steam, 402; converters or transformers, 107; other types of machines, 582. The table gives the division of stations according to rating.

It is interesting to note that the number of gas and oil stations is now considerably higher than that of the pure

water-power stations and is now almost as large as that of the combined water and steam stations. As to the number of meters in use there were employed, as far as the available information goes, 508,868 meters for lighting circuits alone, 108,636 meters for power circuits alone, and 337,511 meters for power and lighting circuits together.

CLASSIFICATION OF STATIONS BY RATING.

Rating, Kilowatts.	Number of Stations.	Rating, Kilowatts.	Number of Stations.
0- 100	985	2001- 5000	59
101- 500	769	5001-10,000	24
501-1000	141	Over 10,000	29
1001-2000	93	Unknown	426

The number of kw-hours sold was available only for 543 stations and was 951,033,000 kw-hours in 1909 and 1,245,541,000 kw-hours in 1911. This means an increase of 31 per cent in two years, or an increase of 15.5 per cent per year, as compared with an increase of 15.8 per cent during the last year in the volume of gas produced by gas plants. As to the voltage used, 258 two-wire direct-current stations use 105 to 125 volts, 601 stations 220 to 260 volts, and nineteen stations other voltages. In three-wire direct-current stations a tension of 2 × 110 volts is used in 543 stations, one of 2 × 220 volts in 470 stations and other voltages in twenty-nine stations. Less uniformity exists in alternating-

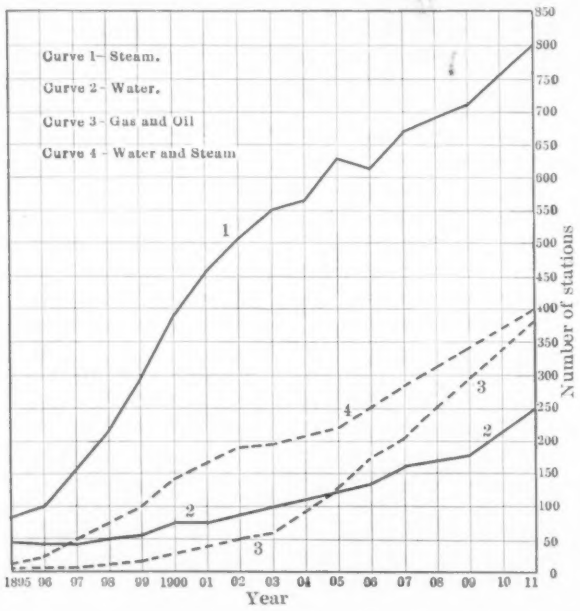

Fig. 3—Increase in Stations Classified According to Prime Movers.

current stations. Among single-phase stations forty-one use a voltage of from 110 to 120, ten from 150 to 170, twenty-one from 220 to 250; seventeen use 2000 volts, nine use 3000 volts, five use 5000 volts, three use 10,000 volts, and 127 stations use other voltages. Among three-phase stations 295 stations use 110 to 127 volts, 372 stations use 210 to 225 volts, thirty-six stations 380 volts, forty-six stations 500 volts, thirty-four stations 2000 volts, ninety-three stations 3000 volts, eighty-seven stations 5000 volts, forty-three stations 5500 to 6000 volts, fifty-two stations 10,000 volts, nineteen stations 15,000 volts, and 149 stations other voltages, the highest being 50,000 volts.

With regard to ownership the stations are classed as follows: Seventy per cent are owned by private persons or corporations and 30 per cent are owned by municipalities or provinces.

Of the 2526 stations, 2053 are devoted exclusively to the production and distribution of electric energy, 56 stations have side lines (bathing-houses, wash-houses, ice factories, etc.), 246 stations are sawmills, smelters, and factories which make electric energy as a side issue.

The Berlin Elektricitätswerke leads with 156,933 kw; then follow, in order, Hamburg with 42,246 kw, Oberschlesischen Elektricitätswerke with 34,967 kw, Rheinische Westfälische Elektricitätswerke with 24,200 kw, Munich with 24,159 kw, Frankfort with 23,989 kw, Bergische Elektricitätswerke in Ohligs with 20,500 kw.

Apparatus for Artificial Respiration.

A device has recently been placed on the market in Europe to perform mechanically the operations of artificial respiration in reviving persons overcome by electric shock.

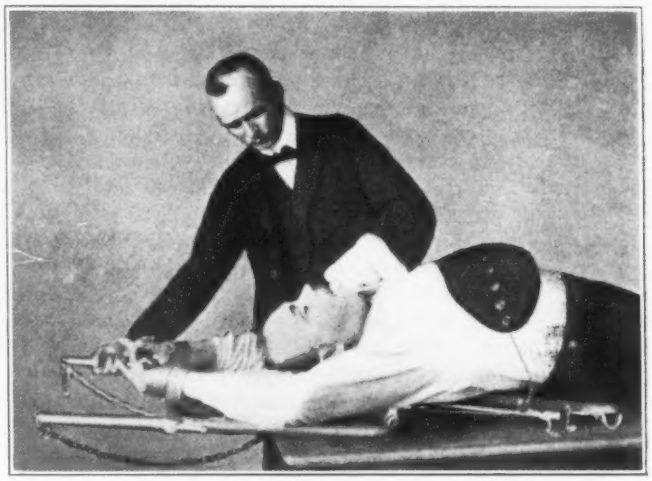

Fig. 1—Respiratory Apparatus in Lowered Position.

by the inhalation of poisonous gases, drowning, etc. The apparatus is for the application of the Sylvester method, and greatly mitigates the labor incident to direct manual operation. It is claimed that the apparatus is easily applicable, that it can be operated by any person and requires only one person to do all the work, including attention to the tongue.

The apparatus and its operation may be readily under-

Fig. 2—Respiratory Apparatus in Raised Position.

stood from the accompanying illustrations. The injured person is placed on a board, which is raised a little at the head end, and the arms are strapped to the levers, the latter being made of ordinary pipe. Across the chest a broad pad is placed, which serves to compress the chest and is connected with and operated by the levers. Wires running

from the end of the levers through small pulleys are connected to the pad by hooks. Several holes at each end of the pad allow for adjustment.

Referring to Fig. 1 it will be seen that the operator is holding out the tongue with one hand and operating the levers with the other. In this position the chest of the injured person is expanded to its fullest extent, no pressure being exerted by the pad. In raising the levers the chest is compressed partly by the movement of the arms of the patient, but more by the pressure of the pad, which is pulled down by the wires. The uniform movement obtained in moving the lever up and down is stated to have a more beneficial effect than in manual operation. The apparatus is reported to have been tested with very satisfactory results at the following institutions of Stockholm, Sweden: Karolinska Institutet, Swedish Association of Physicians (Svenska Läkaresallskapet), the Life-Saving Association and the Royal Hospital. It is manufactured by Aktiebolaget Stille-Werner, Bergsgatan 2, Stockholm, Sweden.

Turin International Electrical Congress.

Telephony and Telegraphy.

In Section VI of the Turin International Electrical Congress papers on telephony and telegraphy were presented. Abstracts of these papers follow:

EFFICIENCY OF WIRELESS-TELEGRAPH APPARATUS.

Dr. J. Erskine-Murray distinguishes four different efficiencies in wireless telegraphy, namely: (1) Commercial efficiency; (2) telegraphic efficiency; (3) operation efficiency; (4) energy efficiency. In a paper he defined each of these efficiencies and stated that they resulted from a very complete analysis of the entire subject. These definitions should serve as a guide to others, and will lead them to pursue systematic methods in the solution of very practical problems in commercial wireless telegraphy.

HERTZIAN AZIMUTHAL COMPASS.

Dr. E. Bellini described a wireless receiver capable of distinguishing the direction of the sending station, and gave results of experiments that have been carried out by the French government.

This device enables a vessel to determine its angular position with reference to a wireless sending station, and the experiments show an average error of only 2 degrees. The device may be installed at points along the shore or on board the ship. The latter method is preferable because it allows the ship's officers to make their own observations. As a result of these experiments the French navy has installed several equipments, and two ships of the Compagnie Générale Transatlantique have also been equipped. Furthermore, the French government, realizing the value of this device in foggy weather, has begun the installation of four wave stations along the coast, which send out waves just as a lighthouse sends out light. These waves have a length of only 80 m and will not interfere with any other wireless systems. Each station has a characteristic frequency and signal and can be instantly recognized by any wireless receiver.

The radio-compass is not capable of receiving waves having a length of several thousand meters, except at very short range; 600-meter waves will operate it at distances up to 20 miles, 300-meter waves up to 50 miles, and so on, the range of operation increasing as the wave-length decreases.

MULTIPLE TELEGRAPHY.

The different systems of multiple telegraphy that have been tried under commercial conditions form the subject of a paper presented by Major W. A. J. O'Meara. The character of each system is briefly set forth and the practical results from actual service are given. The systems covered are: Morse quadruplex, Mercadier system, Phonophone system, Picard system, Delaney system, Baudot system, Murray multiplex, Munier system, and Rowland system.

In conclusion the author referred to the competition between multiplex systems as a class and high-speed automatic telegraphs. He divided telegraphic messages into two classes: (1) Short telegrams relating to business or domestic affairs; (2) long telegrams for the press.

The long telegrams are better adapted to the high-speed system than are the short ones. The author was of the opinion that short telegrams should preferably be treated as separate units in order to facilitate the tracing of errors and to save time in sending and delivering the message. The Baudot multiplex printer has been successful in England, and preparations are now being made to install a sextuple duplex between London and Birmingham. If this installation comes up to the expectations it will be the most rapid printer yet invented for handling large numbers of messages.

Two additional contributions were incorporated in this paper as a supplement—one a short discussion of the "decrement method" of Morse quadruplex with a complete circuit diagram, by Mr. C. C. Vyle, and the other a theoretical analysis of the currents in the "increment method" of Morse quadruplex, by Mr. C. E. Hay.

The report was discussed by Messrs. Duran, di Pirro, Strecker and Carletti.

LONG-DISTANCE TELEPHONY IN AMERICA.

Much information relating to the equipment and operating practices of the Associated Bell Telephone Companies was given in a paper by Mr. Frank B. Jewett. At the present time the Bell telephone system comprises twenty-six local operating organizations, covering all of the United States and a large portion of Canada. About 2,000,000 wire-miles of long-distance telephone lines are in use. Of this total wire mileage about 80 per cent is in the form of open-wire circuits, on 168,000 miles of pole line, and the remainder is in cable circuits, principally underground. In addition to the equipment used exclusively for long-distance business, the equipment for exchange service and for connecting individual subscribers with the toll system comprises about 9,700,000 miles of wire.

Practically all of the open-wire mileage is in the form of hard-drawn copper metallic circuits, many of which are equipped with Pupin loading coils. The copper wire ranges in weight from about 102 lb. per wire-mile to 430 lb. per wire-mile, the most common size weighing approximately 173 lb. per wire-mile. Many of the open-wire circuits are arranged to secure a third talking circuit from two metallic circuits by the phantoming process. The arrangement of open-wire circuits for phantoming is being extended with great rapidity, and with the more intimate development of a combined commercial telegraph and telephone system the compositing and simplexing of total circuits for simultaneous telephone and telegraph operation is being generally applied to all long-distance lines.

In the case of long-distance toll lines in paper cable the soft-drawn copper wires vary in weight from 21 lb. per wire-mile to 166 lb. per wire-mile. The latter size is used in the New York-Washington cable which is now being installed. Whether the wires employed for long-distance circuits in cables are large or small, they are invariably equipped with Pupin loading coils. The same is almost invariably true of all cable circuits employed for bringing open-wire toll lines into cities, whenever the length of such cable circuits is sufficient to warrant the use of loading coils.

The New York-Philadelphia underground cable, which has been in service since the latter part of 1905, is laid in a

subway of standard vitrified-tile duct construction, with six through-ducts and varying numbers of additional ducts to provide for local requirements along the route. The cable has an outside diameter of 2⅝ in., and has a lead-tin alloy sheath ⅛ in. in thickness. It contains ninety-three pairs of No. 14 B. & S. and nineteen pairs of No. 16 B. & S. conductors, and is equipped with inductance coils at intervals of approximately 1¼ miles. A cable 83 miles long will shortly be installed between New York and New Haven. This cable will contain thirty-seven pairs of No. 13 B. & S. conductors for the entire distance, and a varying number of the same and smaller gage conductors along different portions of the route. A cable from Chicago to Milwaukee, a distance of approximately 90 miles, is now in use. This cable contains fifty pairs of No. 14 gage conductors, with smaller conductors where needed for long-distance business to intermediate points. During the present year it is expected that a subway being run between New York and Boston will be completed, and that the cable between Philadelphia and Washington, approximately 140 miles in length, will be installed and equipped with loading coils. At the beginning of 1912 there will therefore be a continuous underground cable from New Haven to Washington, a distance of 315 miles. It is expected that the entire equipment between Boston and Washington will be installed and ready for service by 1914. The cable now being installed between Philadelphia and Washington is of standard mechanical dimensions, and contains fourteen pairs of No. 10 B. & S. gage conductors, arranged to operate twenty-one telephone circuits; forty-two pairs of No. 15 gage conductors, arranged to operate sixty telephone circuits, and eighteen telephone circuits in No. 16 B. & S. gage pairs. The total number of telephone circuits within the lead sheath will be ninety-nine, of which twenty-five will be phantom. All of the circuits will ultimately be equipped with inductance coils, which will be suitable for composite or simplex telegraph work. The paper was discussed by Messrs. O'Meara, Strecker, di Pirro, Saleri and Salvadori.

SELECTIVE WIRELESS TELEGRAPHY.

Prof. P. O. Pedersen briefly outlined the different methods employed or proposed for increasing the degree of secrecy in wireless communication. Simple electrical resonance is of value principally when combined with other methods. Electrical resonance with two slightly different frequencies, one used for transmission of messages and the other for the intervening time, has many advantages over the simple resonance method. The author demonstrates that frequencies that differ by one-half of 1 per cent give entirely satisfactory results. Resonance methods all have the advantage of being little affected by disturbances set up by other stations.

Directed waves limit the interference to a restricted area and when combined with resonance should provide comparatively secret transmission.

Brill's method of sending out predetermined series of waves is too slow to become of any very great importance.

A method devised by Mr. M. A. N. Hovland, a Norwegian naval officer, provides for automatic transmission in secret characters, the sender and the receiver being arranged to translate automatically from the usual to the secret characters and *vice versa*. This system permits a comparatively high speed of transmission.

Finally the author advocated the passage of laws to protect wireless-telegraph systems from interruption and interference, and to punish persons who steal messages or interfere with their transmission. He believed that such laws would be effective in their operation against interference from large and well-equipped stations, and that by using speeds of 100 words per minute and signals that require sensitiveness to a variation of one-half of 1 per cent in the frequency little need be feared from the amateurs and others with small installations and crude apparatus.

In summing up the author recommended the following methods of attaining secrecy of transmission:

(1) Use of secret code.

(2) Use of Hovland's system for short distances and restricted service.

(3) Use of high speed and secret code for long distance or in cases where secrecy is of extreme importance.

The paper was discussed by Messrs. Bellini and Artom.

AUTOMATIC AND SEMI-AUTOMATIC TELEPHONY FOR LARGE CITIES.

A paper by Mr. H. Milon dealt with the advisability of using automatic and semi-automatic telephones in large cities. He briefly described the mode of operation of the manual, the automatic and the semi-automatic, and then proceeded to a comparison of the three systems on the score of quality of service and economy of operation.

Taking the New York Telephone Company's system as giving the best service that can be attained with the manual system, namely, twenty-one and a half seconds for a connection and four seconds for a disconnection, the semi-automatic takes twelve seconds for connection and no time for disconnection, and the automatic takes only eight seconds for a connection and none for a disconnection. Reliability of apparatus seems at present to be in favor of the manual system, but lack of data renders this assumption somewhat doubtful.

On the score of operating expense, the semi-automatic is superior to the manual, and the full automatic is superior to both in medium-size and very large systems, the advantage increasing with the number of calls handled. The author analyzes the various items of expense and plots them with number of calls per day for a 100,000-subscriber system and for a 10,000-subscriber system.

In conclusion the author states that while all telephone experts are not in accord regarding the relative merits of these various systems, it is doubtless true that the future will see a continual improvement and simplification of the automatic systems, while the recruiting of good operators will in all probability become more and more difficult as social conditions improve.

WIRELESS TELEPHONY.

A brief résumé of the present state of development of wireless telephony was given in a paper by Dr. Valdemar Poulsen.

Wireless telephony began in 1878, when Alexander Graham Bell established wireless communication over short distances by utilizing the action of light on selenium. However, this branch of telephony as well as those systems which operate by electromagnetic induction is extremely limited in application.

Electromagnetic waves such as are used in wireless telegraphy offer an entirely satisfactory means of transmission, but up to the present time no thoroughly useful transmitter or receiver has been produced. Probably the best method of generating the wave trains employs the hydrogen arc and the microphone. The mechanical oscillators are very expensive, and the author was of the opinion that they would find little use in the future.

The inability to construct a microphone capable of handling comparatively large amounts of energy constitutes the only present limitation of transmission distance. With a suitable microphone it would be perfectly feasible with present apparatus to transmit wireless telephone messages over the same distances now employed in wireless telegraphy.

The author mentioned different expedients that had been employed for increasing the power capacity of microphones and then gave circuit diagrams of typical transmitting and receiving stations now in use.

One distinct advantage of wireless over ordinary telephony lies in the fact that the timbre of the voice is not

changed with distance; therefore the use of suitable relays offers great practical possibilities.

One of the disadvantages of wireless telephony is the inability to receive messages at a station simultaneously with the sending of messages from the same station. Indeed, an attempt to do so will probably result in the destruction of the microphone.

In its present state of development wireless telephony may be used commercially for distances up to 100 km or 200 km.

The following is an abstract of a paper presented in Section IV. Abstracts of other papers presented in this section appeared in the issue of Dec. 9.

INCANDESCENT LAMPS.

Dr. Berthold Monasch contributed a brief outline of the development of the incandescent lamp, beginning with the carbon-filament lamp shown at the Paris Exposition in 1881 and ending with the drawn-filament tungsten lamp of to-day.

The first practicable metallic-filament lamp is credited to Dr. Auer von Welsbach in 1898. It was an osmium filament and had a specific consumption of 1.5 watts per candle and a life of from 1000 to 2000 hours. However, it was not made for voltages higher than 35 or 40.

The tantalum lamp was placed on the market in 1905 and was followed by the tungsten lamp in 1906.

The low resistivity of tungsten imposed great difficulties on the manufacture of filaments for low candle-power and 110 volts. These difficulties have been overcome and now 110-volt to 150-volt lamps may be had of almost any candle-power between 16 and 1000, and 200-volt to 250-volt lamps may be had of candle-powers between 25 and 1000.

The author remarks that 130-volt lamps could be made for candle-powers as low as 10 were there any demand for such sizes. This led to the observation that the intensity of illumination employed by a people is a general index of the degree of culture of that people.

It was predicted that high-candle-power tungsten lamps will displace all carbon arcs. The tungsten will fill all needs up to 1000 cp, and from that point on to 5000 cp the mineralized electrode arc will hold the field. The author expresses interest as to the behavior of the drawn-tungsten filament under the action of alternating current—whether it will behave as other tungsten filaments or as drawn-tantalum filaments.

Committee on Gas and Electric Schedules in New York State.

A draft of a report by the committee on gas and electric schedules of the Public Service Commission for the Second District of New York State has been sent to companies in the district with a letter by Mr. Charles H. B. Chapin, secretary of the committee.

The committee was appointed on Sept. 7, 1910, at a hearing before the commission and after numerous meetings and much study the draft of a report to be submitted to the commission has been adopted tentatively and sent to each gas and electrical corporation and municipality operating in the district, with a request to hold a meeting for its discussion. Any suggestions should be forwarded to the secretary not later than Jan. 1, 1912, in order that the committee may have an opportunity to consider them before a meeting to be held in the Hotel Ten Eyck, Albany, at 10 a. m., on Jan. 17, 1912.

The report is comprehensive and includes extracts from the Public Service Commission's law relating to the subject of schedules. The obvious purposes of the sections of the law quoted, as stated by the committee, are: (a) To permit reasonable discrimination in the making of rates, justified by special conditions and circumstances unusual so far as general service is concerned, and to prevent such discrimination in rates or otherwise as shall be unjust to any or all consumers or to the public served; (b) to enable the commission in its discretion to require schedules of rates to be filed and published; (c) to enable the commission to prescribe the form of every schedule, and from time to time to make such changes as it may deem wise; (d) to enable the commission to establish such rules and regulations as it may deem necessary, and to modify them from time to time.

In making a complete investigation of the subject the committee found it essential to analyze the circumstances and conditions in respect to the furnishing of gas and electricity, the service rendered and use thereof; to consider the existing methods of charge and define the appropriate meanings of terms used; to classify the purchasers of gas and electricity according to the provisions of the statute and conditions of service and use; to consider the practicability of filing and publishing schedules of rates; to devise forms and methods for the construction and use of such schedules

In a section of the report devoted to the subject of service and service conditions the committee calls attention to the manufacture of commodities by general manufacturers and the practice of railroads and street railways in furnishing a service. The public-service corporations and municipalities operating gas and electric plants, however, produce and sell the commodities gas and electricity, but are permitted to do so only under the condition that an adequate supply shall be available at all times to meet the demands of the public. They, therefore, also render a service, and in this connection the word "service" is commonly used to include both the commodity and the availability of the supply. It consists of not only the commodity but also the plant capacity which may be drawn on at any time. The extent of the service furnished to the consumer consists, therefore, of the quantity of gas and electricity consumed plus the amount of plant capacity maintained on his account and subject to his demand. These two fundamental factors, to which the committee refers as quantity and demand, constitute the basis of all methods of charging.

Gas and electric service may be sold under different conditions. These conditions create six fundamentally different kinds of service, as follows: Continuous service, which is available at any and all times; limited-period service, which is available only at certain specified hours or seasons; optional service, which is to be rendered or discontinued for periods at the call of either the producer or the consumer; re-sale service, which is furnished by one corporation or municipality for distribution and re-sale by another; auxiliary service, which is rendered for limited or unlimited periods as auxiliary to the consumer's plant, and emergency service, which is rendered only in case of break-down of the consumer's plant.

Certain characteristics are more or less constant for all installations in which the uses of the service are the same or very similar. Such facts must be taken into consideration in rate-making. In a description of the various classes of service it is necessary that the kind of service should be stated, and that the circumstances and conditions surrounding the use of the service should be indicated clearly.

In the section relating to methods of charge the committee mentions the fact that many different methods of charge for electric service are in use, while there are comparatively few for gas service. To obtain uniformity of expression, and to explain definitely these different methods, the committee has adopted definitions of terms. These are given in an appendix and relate to flat rate, meter rate, quantity meter rate, demand meter rate, load factor or two-charge rate, three-charge rate, uniform or straight line, block and step. The committee recommends that the definitions be approved by the commission and shall receive as wide publicity as possible, for while these terms are in common use, their exact meaning varies in different localities.

A classification of purchasers is made. The four classifications specified are, in brief: (a) Municipalities, state and federal governments; (b) persons or corporations requiring service under the same or substantially similar circumstances and conditions to those under which service is furnished generally; (c) those who require service for new uses and under conditions which are unknown and cannot be determined until after a trial period; (d) street or other railroad corporations taking service primarily for the propulsion, lighting and heating of cars, and gas or electric corporations taking service primarily for re-sale.

In the consideration of the advisability of a requirement that schedules of rates be filed and published, and of the practicability of such action, the committee discussed separately the conditions governing each of the four classes of purchasers.

In accordance with the statute provision that rates for Class A purchasers may not be required to be filed or published, the committee omits this class from further consideration.

It appears to be practicable to prepare schedules uniform in construction and arrangement of matter contained, showing their service classifications, so far as may be practicable, and the rates, rules and regulations applying to each such classification under Class B. To a greater or less extent there is continual competition with substitutes for service. However, there will be consumers of this class where in order to fit the business new service classifications must be provided. Where there is active competition with respect to isolated plants, the gas and electrical corporations and municipalities must be prepared to act with promptness if they are to have a reasonable chance to secure the business. There will also be instances where service will be required immediately and under urgent conditions. It is, therefore, believed to be desirable that every reasonable opportunity be afforded to secure such business.

The business done with purchasers of Class C is of an experimental nature. It is recommended that the requirements for the filing and publication of schedules be flexible enough to allow new service classifications to be established on short-time notice under some general regulation of the commission. It is recommended that for business taken on with consumers of this class a copy of the contract be filed with the commission, but not published, and that the corporation or municipality making such contract shall, on or before the expiration of one year, either establish in its schedule a classification applicable or give notice that the contract will be terminated at expiration. For the publication of the service classifications, rates, rules and regulations which apply generally throughout the territory served by a corporation or municipality, the committee has formulated schedules of rates which are shown in an appendix to the report. It is believed to be practicable that all changes, other than those for the establishment of new service classifications, should become effective only after thirty days' notice to the commission and the public, or upon shorter notice under special permission from the commission. It is recommended that the commission provide a general regulation permitting the establishment of new service classifications, rates, rules and regulations applying thereto upon one day's notice.

The committee deems it appropriate and desirable that copies of all contracts with purchasers of Class D be filed with the commission. It sees no necessity, however, for the inclusion in schedules of the service classification, rules, regulations and rates applying to purchasers of this class.

In case a final order is entered, it is recommended that where unexpired contracts at special rates exist the rates need not be included in the schedules, but that a list of such contracts be filed with the commission, giving the date of execution and the unexpired period which each has to run. At the expiration of any such contract it should be terminated, or if renewed shall be considered as new business and the general provisions applying to such business shall be included in the schedule.

The form recommended for the filing and publishing of a schedule of rates and an outline of the manner in which it is to be constructed are given in an appendix to the report. Three primary considerations guided the committee. The schedules should show in uniform order of arrangement such information in regard to service classifications, rates, rules and regulations as actual or prospective consumers may need in order to determine for themselves the service best adapted to their conditions and the rate therefor. The schedules should give to the commission full information regarding service and rates. The form for schedules should be such as to cover all classes of business available for a single service or a great variety of services, and its preparation should not impose any unreasonable financial burden upon any reporting corporation.

For such schedules the committee submits detailed recommendations. The schedules should be of loose-leaf form and the size of the sheets 8 in. by 11 in. The loose sheets should be supplied to the corporations and municipalities by the commission, and full and explicit instructions should be prepared by the commission showing the proper method for filling out the schedules and filing, and for posting for public inspection. The filing of schedules should not be considered as preventing the publication of all or any part of such schedules in pamphlet or other form for advertising purposes.

The committee does not feel prepared to recommend to the commission the advisability of entering at this time a final order requiring that the schedules of rates be filed and published. It is recommended, however, that a supply of blank forms be prepared by the commission and furnished to each corporation or municipality. The forms could then be filled out according to instructions and returned, and thereafter all changes should be reported to the commission as required in the instructions, but without regard to the statutory requirement of notice or to the clause requiring special permission from the commission. This course, the committee believes, should be followed for a period of at least one year.

The committee is composed of the following: Messrs. J. C. DeLong, chairman, Syracuse Lighting Company; T. R. Beal, Newburgh Light, Heat & Power Company; J. T. Cowling, Westchester Lighting Company; H. H. Crowell, engineer division of light, heat and power, Public Service Commission, Second District; W. E. Griggs, chief of division of tariffs, Public Service Commission, Second District; C. F. Hunter, chief electrical inspector Public Service Commission, Second District; J. T. Hutchings, Rochester Railway & Light Company; M. W. Offutt, Schenectady Illuminating Company; F. B. H. Paine, Niagara, Lockport & Ontario Power Company; A. C. Smith, Cataract Power & Conduit Company; C. H. B. Chapin, secretary, 29 West Thirty-ninth Street, New York City.

System of Accounts in New Jersey.

A hearing was held on Dec. 5 by the Board of Public Utility Commissioners of New Jersey in reference to a tentative system of accounts applicable to all utilities. Objections were raised by representatives of electric railway, electric light and power, and gas companies to the plan of the commission to require a full compliance with the proposed system of accounting to be adopted by the board for the year beginning Jan. 1, 1912.

It was decided by the board that for the current year the companies should file reports consistent with their present systems of accounting. It was agreed by the board and representatives of the companies present that a committee should be appointed representing each class of

utility, that the statistician of the board should be ex officio a member of each committee, and that on April 1, 1912, the committees should be called upon to make a report of the progress attained in the formulation of a new system.

The committee appointed on behalf of the electric-light companies to consider the complete tentative system of acounts, so far as it is applicable to companies of that character, is composed of the following: Messrs. E. J. Allgaert, J. G. Campbell, F. W. Drawge, E. E. Eysenbach, Frank J. Pryor, Jr., and J. B. Thompkins.

In the complete system of accounts prepared by the board a tentative scheme of general balance sheet and income accounts applicable to all utilities was included. This provided for a division of fixed assets acquired prior to Jan. 1, 1912, from the fixed assets acquired since Dec. 31, 1911. Provision is made for a reserve for accrued amortization. It was provided in the tentative scheme that on and after Jan. 1, 1912, every public utility should carry a reserve for accrued depreciation of tangible fixed assets and for accrued amortization of intangible assets. Separate accounts under the tentative plan were to have been carried for depreciation accrued prior to Jan. 1, 1912, and for depreciation accrued since Dec. 31, 1911, or, in the case of those utilities for which depreciation accounts had already been prescribed, since Dec. 31, 1910.

The classification of construction accounts for electric plant and equipment is based on the standard classification of the National Electric Light Association. The classification of operating expenses for electric operations is also based on the standard classification of the National Electric Light Association. Two classifications of operating expenses are provided, one for companies having gross annual revenues from electric operations of more than $50,000, and the other for companies having gross annual revenues of less than $50,000. The classification for companies with the smaller revenues is capable of still further condensation for companies with gross annual revenues of less than $15,000.

The classification of operating expenses for telephone operations is the same as that contained in the uniform system issued recently by the Interstate Commerce Commission.

Treatment of Depreciation in New York Accounts.

A petition has been filed with the New York Public Service Commission, First District, similar to the petition filed with the Second District commission to which reference was made in these columns on Dec. 9, 1911. It asks for changes in the system of accounts, relating principally to the treatment of depreciation, and similar to those requested in the accounting system of the Second District commission. Nearly all of the electrical and gas corporations under the jurisdiction of the First District commission, including the Consolidated Gas Company, the New York Edison Company and the Edison Electric Illuminating Company of Brooklyn, signed the petition.

Important Hydroelectric Power Decision by Massachusetts Public Service Commission.

The Massachusetts Gas and Electric Light Commission has issued a decision admitting the Connecticut River Transmission Company to the town of Clinton for the purpose of supplying electricity for general power service on a large scale, following the conclusion of hearings upon an appeal to the board by the Clinton Gas Light Company against an order of the Selectmen granting the Transmission company locations in certain public highways. No objection was made by the Gas company to the erection of the Transmission company's line through Clinton on the location granted. The only issue between the two companies was as to what limitations should be imposed upon the distribution and sale of electricity for power by the Transmission company. The town through its counsel urged that the Transmission company should not be restricted to the supply of large power users and that it should not be permitted to sell electricity to the Gas company.

The Connecticut River Transmission Company has constructed a high-tension (66,000-volt) transmission line from the New Hampshire boundary to Gardner, Fitchburg, Clinton, Marlborough and Worcester, where it is selling hydroelectric energy for the most part generated at the South Vernon (N. H.) plant of the company. The system supplies either primary or secondary power, and the company has recently acquired an additional source of such supplementary power in its contract for the output of the State hydroelectric plant installed at the Wachusett dam in Clinton. The company's main transmission line passes through Clinton on its way to Worcester. At this point a substation has been erected in which the current is transformed from 66,000 volts to 13,000 volts. This reduced pressure is carried through Clinton on the locations granted on the order appealed from to the Lancaster Mills, and thence to Berlin, where a connection is made with the system of the Marlborough Electric Company. The Transmission company has but one customer in Clinton, viz., the Wachusett Mills, to which electricity is supplied for mechanical and manufacturing purposes. The Clinton Gas Light Company has been selling electricity since 1887, the power business, however, being very small for a manufacturing town of about 15,000 inhabitants. In June last it supplied but twenty-six motors with an aggregate capacity of 111 kw. Regarding the power rates of this company, the board states that "under the schedule a power customer making a substantial use of a motor of a size reasonably suited to his needs is entitled to a price not necessarily excessive as compared with the prices offered by other electric-light companies of similar size."

The amended charter of the Transmission company incorporates it for the purpose of "generating, manufacturing, storing, transmitting, furnishing, purchasing and selling electricity for mechanical, manufacturing, railroad, railway and heating purposes, and for the use of municipalities * * * engaged in the business of furnishing electricity." Counsel for the town claimed that the company was not incorporated or authorized to distribute and sell electricity exclusively for power. The board points out that the town's contention calls for a construction of Chapter 617, Acts of 1908, which provides that municipal authorities may impose restrictions upon companies securing locations for the sale of electric power exclusively, subject to appeal to the commission. The board points out that it appears clear that the Legislature did not intend to describe a use of electricity confined to the operation of motors, but rather its use for mechanical and manufacturing purposes generally. This broader significance of the term "power" is in keeping with recent developments of the industry. In the rapid and varied extension of electrical applications the terms "light" and "power" are becoming inadequate. The largest electric-light company in the State has found it necessary in its rate schedule to define "power" as "general motor service, cooking, heating, electroplating, charging storage batteries, and similar service, but not including the running of dynamos for lighting purposes." The board therefore concludes that the Transmission company is authorized to sell electricity for "power" within the meaning of the foregoing act. The board says that the purpose to supply large as distinguished from small users is to be tolerated only during such time as may be necessary to establish the public character of the business which the Transmission company is undertaking

and properly to adjust the relations between it and the local agencies for electrical distribution.

The commission further states: "The distribution of electricity through the public streets and its sale for lighting purposes has been recognized as a public service for more than twenty years. This conception of the character of the business has not changed, even though electricity so distributed has come to be applied to other important uses. For the same period it has been the established legislative policy of the State that so long as such an agency for the distribution of electricity in any given territory is adequately and properly performing its public duty the public interest is better served by public supervision and regulation than by competition. The advent of the Transmission company into communities already supplied for the purpose of selling electricity primarily to large consumers for manufacturing and mechanical uses and to a considerable extent as 'secondary power' has developed a novel and important phase of the problem. * * * In each instance which has been brought to the attention of the board the local authorities, as in this case, have attempted to preserve competitive relations between the new company and the one already established, but have hesitated to compel it as a condition of admission to observe all the duties and obligations of a public servant, namely, to serve all with adequate facilities without discrimination and for no more than a reasonable compensation, since such a requirement, being obviously not included in the company's purpose, might discourage or wholly prevent the entry of the new company into the field for any purpose whatever. Anything short of an insistence on this condition must, however, inevitably fail to give the entire community the advantage of two sources from which electricity for mechanical and manufacturing purposes may be purchased. On the other hand, an insistence upon this condition will probably ultimately result in no greater advantage to the community than its supply by one public-service agency properly regulated and supervised. * * *

"Unless compelled by law, any sale of electricity by it (the Transmission company) to small power users will be casual and incidental to its primary purpose. If compelled by law to supply any one customer, there is no sound reason why it may not be required to supply all who may desire its service and to extend its lines so far as may be reasonably necessary. * * * In that event there is at least doubt whether it can charge much if any less than the price at which the Gas company can afford to sell. * * * Inasmuch as experience has developed that low prices for electricity for light are directly dependent upon the extent and diversity of the use of electricity for other purposes, it seems fair to conclude that any attempt to compel these two companies to observe competitive relations may not result in any advantage to small users of power, and, if it does, then only at a corresponding disadvantage to the community as a whole.

"The board has for some time been of the opinion that the public interest in the distribution of electricity by means of the public streets is not to be measured by the use to which electricity is put after its delivery to the customer. If cheap power is to be made available to a community, it must be through some common public-service agency. It is for this reason that the board believes that the Transmission company should not be excluded from selling to the Gas company, but rather should be free to do so and the latter company should be willing to buy if thereby it can obtain its electricity cheaper than it can generate it. * * * For the time being at least an arrangement similar to that followed in Worcester is in the judgment of the board sufficient. Under it the Transmission company may supply customers whose requirements are too great to make it profitable for the Gas company with its present plant and business to undertake their supply. * * * The provision in the Selectmen's decision by which the rights granted by them are to terminate at the end of twenty-eight years is a distinct departure from the legislative policy and practice of many years, which has been to grant indeterminate, revocable franchises in cases similar to the one under consideration. The only advantage of the provision in question from any standpoint is that at the expiration of the term a certain measure of control may revert to the Selectmen. If this condition was thought to be of importance, it is difficult to understand why so long a period was named. * * * The board believes that such a provision is inexpedient, and that its effect if employed would be to weaken the public control of the situation, and to discourage rather than to encourage the highest development of the properties involved and the lowest charges for their service."

The commission therefore gives the Transmission company authority to occupy the locations laid down by the town, subject to the general jurisdiction of the latter. Joint occupancy of poles is recommended, with a 14,000-volt limitation under normal working conditions. The Transmission company is authorized to supply electricity to the Gas Light company, electric railways and railroads, but is not permitted to supply to any other customer whose apparatus does not offer a connected load of 300 hp, or whose annual energy consumption is less than 450,000 hp-hours, as in the late Fitchburg and Worcester decisions. In case the town acquires a municipal lighting plant the company, on request, is ordered to supply energy to it to an amount not exceeding 800 hp of maximum demand, and at a rate not exceeding the lowest rate given by the company to any other municipality in the State.

Public Service Commission News.

NEW YORK COMMISSION.

The Public Service Commission, Second District, has authorized the Northern Westchester Lighting Company to issue $72,000 of its 5 per cent bonds due Jan. 1, 1955. The bonds are to be sold at not less than 95 and the proceeds used to discharge matured bonds of the Sing Sing Gas Manufacturing Company for the purchase and cancellation of the bonds of the Sing Sing Electric Light Company.

The Newfane Electric Company has been authorized to issue additional stock to the amount of $7,000. The proceeds derived from the sale of the stock are to be used for the payment of expenditures incurred for proper capital expenses.

The Jamestown Lighting & Power Company has been authorized to exercise rights and privileges conferred upon it by a franchise granted by the Town Board of Ellicott, Chautauqua County, for the furnishing of electricity for all purposes.

The Warwick Valley Light & Power Company has been ordered to show cause before the commission at Albany on Jan. 8 why an order should not be entered requiring it to improve its distribution system in accordance with recommendations made to the commission by one of its inspectors, and to place the system in safe condition so that it will properly serve the public. The complaint was received by the commission from the Village Trustees of Warwick, and an inspector, after examining the plant, has pointed out various things necessary to put the plant in proper condition.

The Meridian Telephone Company, of Meridian, Cayuga County, N. Y., has submitted a petition asking that the New York Telephone Company be required to show cause why it should not be ordered to connect with the Meridian Telephone Company for interchange of traffic and communication. The petition states that in 1905 it made a contract as a connecting company with the New York Telephone Company, but that in September, 1911, that company canceled

the contract because of arrears for rentals of telephones for a period of more than thirty days, but agreed upon payment to it of said arrears to enter into an agreement with the Meridian Telephone Company, but that after the indebtedness was paid the New York Telephone Company refused to ratify the contract between the two companies for the reason that it had given to the Cato & Meridian Telephone Company the exclusive contract for interchange of traffic in that district; that by reason of this refusal the members and patrons of the Meridian Telephone Company have been discriminated against illegally and unconstitutionally, and that no valid reason exists why the New York Telephone Company should not enter into an agreement or contract for one year with the Meridian Telephone Company under the same terms given to other connecting companies. The New York Telephone Company has been required to answer the complaint within ten days.

A complaint has been entered by the Lenham Mercantile Company and others, of the city of Lackawanna, N. Y., directed against the New York Telephone Company. The complaint alleges that for the past ten years telephone service has been furnished for the sum of $108 per year, which included communication in the city of Lackawanna and any part of the city of Buffalo; that the company has inaugurated a new rate schedule which provides for a flat rate with subscribers within the corporate limits of the city of Lackawanna, the village of Blasell and part of the towns of West Seneca and Hamburg for $50 per year, the new local area to be known as Lackawanna, and providing for a toll rate of 5 cents per message between Lackawanna and Buffalo, Gardenville, Hamburg, Orchard Park and Wanaka; that the rate of $50 per year for service within the Lackawanna area is unjust and unreasonable because of the small number of subscribers within that territory. The complaint has been served upon the company with an order to answer the same within ten days. Pending a decision of the case upon its merits the commission has suggested to the complainants that they sign the new contract as drafted by the company, having induced the latter to incorporate a ten-day cancellation clause.

MASSACHUSETTS COMMISSION.

The Gas and Electric Light Commission has approved the issue of new capital stock to the amount of $5,000 par value by the Seekonk Electric Company for the purpose of purchasing the lines of the Narragansett Electric Lighting Company, of Providence, R. I., within the town. The company plans to purchase energy from the Narragansett company and to distribute it in Seekonk and Swansea. The estimated value of the existing lines in Seekonk is about $1,000, and extensions will be made to the extent of about $5,400. The proceeds of the sale of ten shares are to be devoted to the purchase of the present lines, and the proceeds of forty shares to the construction of the extensions.

Much interest has been aroused by the publication of the recent decision of the commission admitting the Connecticut River Transmission Company to the town of Clinton, subsequent to the appeal of the Clinton Gas Light Company. The action of the commission in cutting out the limited franchise restriction granted the company by the municipality and substituting therefor an indeterminate franchise has received favorable comment in many quarters.

MARYLAND COMMISSION.

The Maryland Public Service Commission received last week from the Consolidated Gas, Electric Light & Power Company, of Baltimore, a report of the valuation of its property. The total is $44,072,415, divided as follows: Physical property, $26,400,845; working capital, $1,000,000; investments, $222,537; intangible assets, $16,379,033. The report includes the actual investment in the Baltimore Electric Company and the present value of the property, the value of the Consolidated Gas, Electric Light & Power Company, electric division, assets and liabilities of the Baltimore Electric Company, and the combined assets and liabilities of the Consolidated and the Roland Park Electric companies. The report argues at length that the company should be allowed to earn dividends on intangible assets which represent money spent in the early years of the company and losses of various kinds in development. It is explained that in the early years of the company sufficient sums were not set aside for depreciation, and that allowances had to be made for these losses when it came to make renewals. In support of this contention the company cites a decision of the Wisconsin Public Service Commission which allowed intangible assets to be considered. Figuring on the Wisconsin basis the company reaches the conclusion that its intangible assets amount to $31,313,318, and that the lesser sum claimed is purely arbitrary in order to make the company's assets equal its liabilities. The valuation of the property is based on the amount it would cost to reproduce it new. Referring to the intangible assets, it is stated that they constitute the additional investment necessary to build up the business, much in the same way as that in which the cost of construction represents the cost of the physical plant. This appears to hold good at least until the deficits or the investments occasioned by them have been made good and restored to the investors either through surplus profits or in some other form. It is held that such treatment of the cost of building up the business is equitable as between the investors and the consumers, and that in the long run it is necessary in undertakings of this character in order to obtain the capital that is required.

No date has been set by the commission when the hearing on the Consolidated case will begin. At present Chief Engineer Charles E. Phelps and Auditor John A. Tompkins of the commission are at work on certain data which when completed will enable them to test the accuracy of the company's figures. It is probable that the commission will make efforts to get the city of Baltimore to share the burden of expense incident to the hearing of the case, such as the employment of gas and electric experts who may be required. It is recognized at the office of the commission that the principal issues hinge on the valuation placed by the Consolidated on its intangible assets, upon which it claims the right to earn dividends just as upon its physical assets.

OHIO COMMISSION.

General E. B. Finley, attorney for the Bucyrus Light & Power Company, has secured permission from the Ohio Supreme Court to file a motion for a writ of mandamus to compel the Public Service Commission to hear the case of the company against the city of Bucyrus, the City Council of which has enacted a franchise ordinance fixing rates for service that are considered unreasonable. A petition was filed with the commission, but it was afterward dismissed without consideration on the ground that the ordinance was passed before the commission was organized. The question for the Supreme Court to decide is whether the commission can be compelled to take up cases in which the causes and grounds existed before its organization. Members claim that if this were true it would open the way to review acts that took place in the distant past, and perhaps result in the damage of securities that were based upon conditions as they existed before the public utilities law was enacted. General Finley criticises the law as crazy-patchwork, and says that it is made up of parts of laws of other states, and that it would take a Philadelphia lawyer to interpret it. On the other hand, it is held that the law was purposely framed to render it difficult of application, and it is pointed out that the appropriation for its enforcement is so small as to nullify its execution. The decision will be of great importance to public service corporations throughout the State, as the question has been raised several times.

The Cleveland Electric Illuminating Company, of Cleveland, has asked for permission to issue $1,500,000 of 5 per

cent bonds to be sold at a price the commission may fix, and the same amount of common stock to be sold at par. The company states that $663,612.85 of this is to be used to refund expenditures from income for betterments and extensions, while the remainder, with other funds now on hand, will be used in making additions to the generating and distribution facilities. The company is building a new central station, but declines to go into details as to just what the funds will be used for further than is covered by this statement.

The Columbus, Urbana & Western Railway Company has asked for authority to issue $50,000 stock and $5,500,000 bonds, from the proceeds of the sale of which it is the intention to extend the line from Fishinger's Mill to Findlay and build a line between Wapakoneta and Kenton. This would give Columbus direct connection with Toledo and the western part of the State. S. A. Hoskins, of Wapakoneta, who represented the company, said the bonds would be sold at 80. It is said that if permission is granted to issue the securities the property will be sold and work will be begun on the extensions at once.

The Cleveland, Painesville & Eastern Railway Company has requested authority to issue $211,000 forty-year 5 per cent bonds to reimburse the company for expenditures from income for betterments and extensions.

CURRENT NEWS AND NOTES.

American Institute of Consulting Engineers.—The annual meeting of the American Institute of Consulting Engineers will be held on Jan. 16, 1912, at the Aldine Club, Fifth Avenue and Twenty-third Street, New York, at 8 p. m. Preceding the meeting an informal dinner will be served at the club, beginning at 6:30 p. m. Mr. Eugene W. Stern, 103 Park Avenue, New York, is secretary of the Institute.

* * *

Wood Preservers' Association.—The eighth annual meeting of the Wood Preservers' Association will be held at the Hotel Sherman, in Chicago, Ill., Jan. 16-18, at which several papers will be presented relating to line poles and electric-railway ties. This association has nearly doubled in membership since the last meeting and a large attendance at the meeting is anticipated. Mr. F. J. Angier, First National Bank Building, Chicago, is secretary.

* * *

Probable Telephone Merger in San Francisco.—At the meeting of the Board of Supervisors of San Francisco on Dec. 4 an ordinance was introduced at the request of the Bay Cities Home Telephone Company granting that company permission to dispose of its interests to the Pacific Telephone & Telegraph Company, which is the Bell company, controlled by the American Telephone & Telegraph Company. The negotiations leading up to this stage of the proposed merger have been in progress for several months.

* * *

Electrical Contractors' Association of New York.—The annual meeting of the Electrical Contractors' Association of New York will be held in the Building Trade Club, New York City, Jan. 16, 1912. No stated program has been arranged, legislation at Albany and routine business being all that will be considered. There will be two sessions, divided by a luncheon. After the meeting the association members will be the guests of the Electrical Contractors' Association of New York City, which will give a tea and reception at the Building Trade Club at 4:30 p.m. and a theater party at the Winter Garden in the evening. After the performance the guests will be taken in automobiles through the "Great White Way" to the Building Trade Club again, where supper will be served, followed by a smoker and other entertainment. Mr. J. R. Strong is chairman of the local committee having the affair in charge.

* * *

Electric Vehicles at the National Automobile Shows.—Eighteen different makes of electric vehicles will be exhibited at the New York and Chicago automobile shows this winter. Eight of these will be displayed at the Madison Square Garden Show from Jan. 6 to 20, six others at the Grand Central Palace Show from Jan. 10 to 17, and thirteen makes at the Chicago Show in the Coliseum and First Regiment Armory from Jan. 27 to Feb. 15. There will be no duplication of exhibits in the two New York shows, which will be open concurrently, but many of the makers who exhibit in these shows will make displays also in Chicago. Four of the electric-car companies will exhibit passenger cars during the first week and commercial vehicles during the second week, both in New York and Chicago.

* * *

Recent Additions to Boston Edison System.—The Edison Electric Illuminating Company of Boston has lately added a synchronous motor-generator installation at Atlantic Avenue to facilitate the economical handling of the three-wire underground direct-current service which centers at that point. By means of these machines, of which there are five having an aggregate rating of 4500 kw, it is possible to shut down the steam-driven equipments at periods of light load, carrying the service entirely through the L Street connections with the motor-generators; while in emergencies it is possible to utilize these machines to supply alternating current to the system. Another recent improvement in the company's service covers the installation in numerous substations of mercury-arc rectifiers and constant-current transformers, and the consequent subdivision of the arc-lighting load, in place of the former plan of handling it all from L Street through synchronous motor-generator sets located in the original steam-engine-driven section of the station.

* * *

Northern Mexico 75,000-hp Hydroelectric Plant.—Further details of the plans of the Compañia Hydro-Electrica Mexicana for the installation of hydroelectric plants and the construction of power-transmission systems in Northern Mexico have been made public. The concessions which the company has taken over give it the right to utilize the water of the Rio Blanco in the States of Tamaulipas and Nuevo Leon and of the Rio de los Naranjos in the San Luis Potosi for the development of electric power. The company, which has a capital stock of $15,000,000 gold, is now having surveys made preparatory to beginning the work of constructing the first two hydroelectric plants upon these streams. It is stated that the plans call for the development of approximately 75,000 hp. The transmission lines will be extended within a radius of 150 miles of the hydroelectric plants and will supply the cities of Monterey, Saltillo, Tampico, Victoria, Montemorelos, Linares and San Luis Potosi, as well as a number of smaller places and thriving mining camps. It is announced that contracts have been let for hydraulic and electric works. The carrying out of the present plan will involve the expenditure of more than $10,000,000 gold, it is stated. Under the concessions held by the company from the government, it has available water supply sufficient to develop more than 100,000 hp of electrical energy, and this full power will be ultimately reached. The officers of the company are: Mr. Thomas Makinson Sanders, president; Mr. Manuel Migoni, secretary, and Mr. José Romero, manager. The above information supplements that given on the same project in the Nov. 25 number.

NATIONAL INDEPENDENT TELEPHONE CONVENTION.—The next annual convention of the National Independent Telephone Association will be held in Chicago on Feb. 7, 8 and 9, 1912.

* * *

BYLLESBY CONVENTION.—The annual convention of H. M. Byllesby & Company will be held in the Congress Hotel, Chicago, on Jan. 2 to 5. The Byllesby conventions have come to be large and successful gatherings, with representatives of over 100 public-service properties in attendance.

* * *

LOUISIANA ELECTRICAL CONTRACTORS.—At the last annual meeting of the Louisiana Electrical Contractors' Association, held in New Orleans, the following officers were unanimously re-elected: Mr. Roydan Douglas, president; Mr. Thomas J. Burke; vice-president; Mr. Henry Widner, treasurer; Mr. W. H. B. Spangenberg, secretary, and Mr. W. H. Earl, sergeant-at-arms.

* * *

POWERFUL ITALIAN WIRELESS STATION.—A wireless-telegraph station has just been completed at Coltano, Italy, which was designed and built under the direction of Mr. Marconi, and has a 1000-kw equipment. The aerial is nearly 4000 ft. long and has a range, it is calculated, over a radius of several thousand miles. It is stated that the Marconi station at Clifden succeeded during Mr. Marconi's recent visit to Argentina in communicating with him in Buenos Aires, a distance of nearly 7000 miles. The Coltano station has considerably higher power available than that at Clifden. It has already communicated with Clifden and Glace Bay.

* * *

HYDROELECTRIC DEVELOPMENTS IN SPAIN.—A concession has been granted to a company under the name of the Energia Eléctrica de Cataluña for the utilization of certain waterfalls in the Pyrenees for electrical generation. The company has been organized by French and Swiss financiers with a capital of $1,800,000, which sum later will be considerably increased. At first it is proposed to furnish the city and province of Barcelona with electrical energy and later to extend the system to supply energy for various Catalonian industries. The company has already started work to develop two waterfalls, one of which has a height of 2490 ft. and a capacity of 30,000 hp. The construction of a stand-by steam plant and double transmission lines has also been started.

* * *

ILLINOIS LEGISLATIVE PUBLIC UTILITIES COMMISSION.—The joint committee of Senators and Representatives of the Illinois Legislature which is investigating the subject of public-utility regulation, with the idea of recommending to the Legislature the establishment of a public service commission in the State of Illinois, will resume its work after Jan. 1. At that time it is proposed that the committee, which bears the title "Illinois Legislative Public Utilities Commission," shall make a tour of Illinois cities for the purpose of studying public-service conditions and conferring with managers of public utilities at first hand. Senator John Dailey, of Peoria, is chairman of the committee, and Representative William R. Holaday, of Danville, Ill., is secretary.

* * *

BALTIMORE A. I. E. E. SECTION.—The December meeting of the Baltimore Section of the American Institute of Electrical Engineers was held at the Raleigh on Dec. 15, Dr. J. B. Whitehead, chairman of the local section, presiding. A banquet in the private dining-room of the hotel followed the meeting. Dr. Whitehead was toastmaster, and after an elaborate menu had been served he addressed the gathering, giving an account of his visit to the International Electrical Congress of Turin, Italy. When he finished speaking he introduced Mr. A. S. Loizeaux, who spoke about the new storage battery now being used by the Consolidated Gas, Electric Light & Power Company, an account of which appeared in these columns last week. Mr. C. G. Edward, of the Public Service Commission, described the latest thing in telephones, the auto-manual telephone, which is now on exhibition in the Public Service Department in the city hall. Several other speakers followed, after which a toast to Dr. Whitehead was drunk. Forty-two engineers attended the affair.

* * *

NEW YORK SECTION, I. E. S.—"The Conservation of Vision" formed the subject of discussion at a meeting of the New York Section of the Illuminating Engineering Society held on Dec. 14, the paper of the evening being presented by Dr. Ellice M. Alger. The author described several of the many causes for impaired vision and outlined the work undertaken by the American Association for the Conservation of Vision, which is co-operating with all societies in the accumulation of data and dissemination of knowledge among the general public. Arrangements have already been made for four of the future monthly meetings of the section. In January the subject will be "Street Lighting." In February the effect of light on the eye will be discussed. "Light for Photography" will be the subject at the March meeting. At the April meeting mine lighting and marine lighting will be discussed. Mr. G. H. Stickney was elected chairman of the section to succeed Mr. Bassett Jones, who resigned on account of pressure of other business.

* * *

NEW ENGLAND N. E. L. A. SECTION TO HOLD CONVENTION.—At an executive committee meeting of the New England Section of the National Electric Light Association held on Dec. 14 it was decided to hold a convention in March, 1912, in connection with the annual meeting. The place has not yet been determined, but will be outside Boston, as the fall convention next year will be held during the Boston 1912 Electric Show, probably in October. New quarters have recently been established by the New England Section on the eleventh floor of the Lawrence Building, 149 Tremont Street, Boston, in charge of Miss O. A. Bursiel, secretary of the section. Committee meetings are held here, and the office is designed to be utilized as a clearing house of information for the section, which now has a membership of nearly 800. A vigorous campaign for additional members is now under way, considerable friendly rivalry being in evidence between the section and the new geographic branch of the association in the Northwest, each branch being determined to muster the largest number of adherents before the Seattle convention in June.

* * *

THE MAGNET AND LINES OF FORCE DEFINED.—In a printed circular received from A. E. Mellick, Dunedin, New Zealand, entitled "Why Does a Magnet Attract?" the following definition of a magnet occurs: "A magnet is a hoop of metal with a hiatus, that it is endowed with a complete orbital gyronic movement through its fabric and hiatus, which in its action attracts cosmogonic gyrons in a certain ratio to the feebleness of intensity of the orbital gyronic movement: that the gyrons, still continuing their journey through the space of the hiatus, continue to attract cosmogonic gyrons to the extent of attracting the gyrons of pieces of metal which may be in their neighborhood." Lines of force, the writer says, are constituted by a continual procession from pole to pole resulting from the orbital gyrons following their course. "The lines of force are broken by the revolution of the armature, conducted to the commutator, collected by the brushes, conducted to the magnet, thus stimulating it to an excessive degree to attract a larger number of cosmogonic gyrons, and at length sent on their errand of usefulness in providing us with power, light and heat."

Maine Electrical Association.—A meeting of the Maine Electrical Association will be held Jan. 18 at Bath, Maine, at which several papers will be presented. The entertainment will include a "shore" dinner. Mr. W. S. Wyman, Waterville, is secretary.

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Armour Institute Branch of A. I. E. E.—At a meeting of the Armour Institute of Technology Branch of the American Institute of Electrical Engineers held on Dec. 13 Mr. P. A. Strong, of the class of 1912, read a paper on "Chicago & Northwestern Railway Terminal Signal Equipment."

* * *

Subway Project in Chicago.—The finance committee of the City Council has approved an appropriation of $202,200 for salaries and expenses of the subway commission for the ensuing year. In addition an appropriation of $2,000,000 for actual construction work on the subway was approved, subject, however, to a possible referendum to the voters of the city at the election of next April.

* * *

Northwestern Cedarmen's Association.—The next annual convention of the Northwestern Cedarmen's Association will be held in Minneapolis on Jan. 23 and 24. This association is of interest to electrical men from the fact that it is composed of producers of white-cedar poles. Mr. T. H. Partridge, of Minneapolis, is president, and Mr. H. H. McKinney, 743 Lumber Exchange, Minneapolis, is secretary.

* * *

Publications of American Society of Civil Engineers.—In the future only one volume of the *Transactions* of the American Society of Civil Engineers will be issued annually, instead of four volumes as heretofore. This volume will contain approximately as much material as the four quarterly volumes combined, but its bulk will be less than for the others on account of the use of thinner "Bible" paper.

* * *

Peoria Electrical Show.—Mr. Leroy A. Mills, president of the Mills Electric Company, of Peoria, Ill., announces that an electrical show will be held in the Coliseum in Peoria during the week of Jan. 22-27, 1912. In view of the fact that there will be no Chicago electrical show this winter it is thought that there is an especially good opportunity for a successful exhibition in Peoria. It is said that the indorsement of a number of prominent electrical manufacturers and dealers has been secured. A small admission fee will be charged, and several entertainment features are planned to make the show popular.

* * *

Chattanooga Electrical Exposition.—The Chattanooga (Tenn.) Chamber of Commerce has under consideration plans for an electrical exposition which is intended to mark the completion of several hydroelectric power projects in eastern Tennessee. Mr. G. H. Patten is chairman of the committee in charge of the project, and a meeting of the committee and officers and directors of the chamber will be held soon to discuss details of the plan. The idea at present is to organize a stock company to put the exposition on its feet and to hold the event some time in the fall of 1912, when it is expected that the Eastern Tennessee Power Company and other water-power companies will have their plants in operation. The capitalization of the exposition company will probably be $50,000.

* * *

Electrolysis Danger Slight in Chicago.—Addressing the Chicago Real Estate Board at a recent luncheon, Mr. Ray Palmer, the consulting engineer who made a recent report to the commissioner of public works of Chicago on the subject of dangers to underground metallic structures from corrosion due to the electrolytic action of stray electric currents (*Electrical World*, Dec. 2, 1911, page 1342), said that there is no cause for any particular apprehension as to the result of electrolysis in that city. The city authorities are taking the necessary steps to meet the condition by requiring the electric-railway companies to improve their return-circuit conditions to such an extent that the drop in the return circuit will not exceed a maximum allowable drop of 12 volts. The electric "drainage" system recommended by Mr. Palmer was explained.

* * *

Sludge in Chicago Drainage Canal May Affect Power-Plant Operation.—The trustees of the Sanitary District of Chicago have adopted resolutions directing that settling tanks be placed at the mouths of sewers emptying into the Chicago River and the Drainage Canal. It is asserted that sludge is forming so rapidly in the Drainage Canal that the present system of purification of sewage by dilution will soon reach its maximum capacity. It is pointed out that new methods of sewage disposal are urgent because the forebay of the hydroelectric power station at Lockport is already clogged to some extent by sludge, the deposits extending 2 miles north to the controlling works in the rock section of the cut. The seventh Crocker-Wheeler 4000-kw generating unit at the Lockport station has been completed recently at a cost of $24,369, making the total rating of the station generators 28,000 kw.

* * *

Engineering at Northwestern University.—Considerable new equipment has been added recently to the various laboratories of the College of Engineering of Northwestern University, Evanston, Ill. Small Corliss and high-speed engines, a steam condenser with engine-driven vacuum pump, a gas engine, a hydraulic ram, a centrifugal pump, a small 60-cycle generator, an oscillograph, an electric blueprint machine and other appliances have been placed in position in this recently established department of the university. The engineering society has changed its name, and is now known as the Engineering Society of Northwestern University. It has listened to a number of addresses, including that of Mr. Frank F. Fowle on "Problems of the Engineering Graduate," and "Principles Involved in the Artificial Production of Light," by Prof. W. C. Bauer. The plans of the society for this winter embrace inspection trips to the Hawthorne works of the Western Electric Company and to the Milwaukee factory of the Cutler-Hammer Manufacturing Company.

* * *

South Shore Plan in Chicago May Hasten Illinois Central Electrification.—An agreement between the South Park Commissioners of Chicago and the Illinois Central Railroad Company, which will no doubt be approved by the city authorities, provides for relinquishment by the railroad company of its riparian rights along the shore of Lake Michigan in Chicago and the establishment of a lake-front park strip connecting Grant Park and Jackson Park. The plan involves the erection of a large and handsome building for the Field Museum of Natural History, now located in Jackson Park, at the foot of Twelfth Street, which will be boulevarded. It would seem to be natural that these extensive plans for improving the city, following out to some extent the Chicago Plan, should almost necessarily involve the electrification of the Illinois Central terminal service. President Markham of the railroad company says that the present plan has no connection with the electrification investigation, which is being considered separately. However, it is hoped that the beautification of Chicago's lake front from Twelfth Street to Fifty-first Street will not be marred by the smoke, noise and cinders of steam-railroad locomotives.

CALGARY HYDROELECTRIC PLANT.

Development at the Horseshoe Falls, Bow River, 50 Miles West of Calgary, Alberta, of the Calgary Power Company.

Single-Circuit, 50,000-Volt Aluminum Transmission Line Between the Generating and the Terminal Station—Energy Sold to Large Cement Mills and Also to Municipality for Railway and Lighting Purposes.

THE following is a short description of the plant of the Calgary Power Company, which was put into operation during the past summer and which is now supplying energy to the city of Calgary and to two large cement mills, one in Calgary and the other in Exshaw, Alberta, Canada.

GENERATING STATION.

The generating station is located on the Bow River at Horseshoe Falls, about 50 miles west of Calgary, Alberta. A double-circuit, 12,000-volt, three-phase, 60-cycle transmission line runs from there to Exshaw, about 8 miles west, to a substation located near a large cement mill. Two 55,000-volt, three-phase, 60-cycle, single-circuit pole lines run over different routes to the terminal station at Calgary. The accompanying photographs illustrate the location of the plant and some various phases of the construction work.

Fig. 1—General View of the Development of Calgary Power Company.

A concrete dam was constructed across the river just above the falls in order to take advantage of the high banks which extend upstream for a few miles from this point. The dam is provided with four hydraulically operated sluice gates, also with stop-log and flash-board spillways and with an ice run. After passing through the screens the water enters the steep penstocks and is carried to the turbines in the power house and discharged into the river below the lower falls, giving a total head of 73 ft.

The sluice gates are of steel and each is raised or lowered by means of two pistons operated by oil under pressure. Two direct-connected, motor-driven pumps are installed for the operation of these gates, and together with the piping and valves are located in the house built over this portion of the dam. A special grade of non-freezing oil is used. Butterfly valves and stop-logs are provided in the concrete head-block at the entrance to each penstock.

The present installation in the power house consists of two 3750-hp Jens Orten-Boving turbines direct-connected to two horizontal-shaft 2500-kva, three-phase, 60-cycle, 12,000-volt, 300-r.p.m. generators; one 6000-hp Wellman-Seaver-Morgan turbine direct-connected to one 4000-kva, three-phase, 60-cycle, 12,000-volt, 225-r.p.m. horizontal-shaft generator, and two 330-hp Jens Orten-Boving turbines direct-connected to two 175-kw, 125-volt, 700-r.p.m. exciters. The transformer equipment consists of two 3000-kva, three-phase, 55,000-12,000-volt oil-insulated, water-cooled transformers and three 43.7-kva, single-phase, 12,000-550-volt self-cooled transformers for station service. Provision is made for a fourth generator unit of 4000-kva capacity and two additional 3000-kva transformers and for a 175-kw motor-driven exciter set for future installation. The generators and exciters were furnished and installed by the Canadian General Electric Company. All switching equipment and the transformers were supplied and erected by the Canadian Westinghouse Company.

CONTROL.

The switching equipment is electrically operated and is controlled from a control desk located on a gallery overlooking the generator-room. The main instrument board is directly in front of the control desk and is supported on columns at a sufficient height to allow the operator a clear view of the generator-room floor. At the rear of the gallery is the recording instrument and relay board, containing all the curve-drawing and integrating instruments and the inverse time-limit, overload relays for all the automatic line and transformer switches. On the main floor and in such a position that it can be seen by the operator on the gallery is the direct-current board controlling the exciters and the generator fields and containing the Tirrill regulators. The generator-field switches are electrically operated from the control desk, while the field ammeters are of the illuminated dial type, so that they may be read from the gallery. At the rear of the direct-current board are the station service-distributing panels, the space between the two boards being closed in with expanded metal screens. Two Tirrill regulators are installed, with provision for a third if necessary, in order to regulate the voltage at Calgary and Exshaw.

The cables from the generators run in conduit to a basement under the center of the generating-room, thence on open shelves along a subway passage to the basement of the switchroom, where the generator instrument transformers are located in a concrete structure. The oil switches and busbars are located on the floor above in concrete compartments. Two sets of busbars are used, one

for the Exshaw and local service, the other for the step-up transformers. The Exshaw bus may be fed direct by either of the 2500-kva generators, or it may be connected to either section of the main bus through an oil switch. This bus feeds the two outgoing 12,000-volt lines and the feeder to the station service transformers. The single main bus is sectionalized into two sections. Each section is fed by a 4000-kva and a 2500-kva generator, and supplies two 3000-kva transformers.

Fig. 2—Penstocks, Transformer and Switch Rooms and Power House.

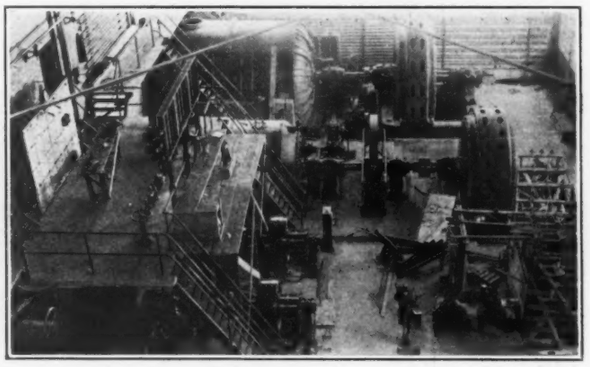


Fig. 4—Interior View of Horseshoe Falls Station During Construction.

The transformers are installed in pockets on the lower floor of the transformer building, two pockets being built on either side of a central passageway. The transformers are provided with wheels in the base to enable them to be run out on a transfer truck in the passageway and either placed in another pocket or shifted to a position under a chain hoist for dismantling. The upper floor of the transformer building contains all the 55,000-volt busbars and switches and arresters. The busbars are of No. 0000 hard-drawn copper supported on porcelain insulators on a pipe framework which also carries the disconnecting switches. The leads from the transformers on the floor below pass up through large floor openings, which are protected with a pipe railing and wire screens 6 ft. high. The 55,000-volt busbars are in two sections, one along each side of the room and tied together through a non-automatic oil switch. The line oil switches are at one end of the busbars, and from these switches the outgoing leads pass upward through disconnecting switches and air-type choke coils through the roof outlet bushings and over the roof to the pole line. Electrolytic lightning arresters are installed on these lines, the horn gaps being mounted on the roof with the tanks in the high-tension room below. On each outgoing line 55,000-volt series transformers are installed for use with the relays and Tirrill regulators.

The low-tension switchroom, besides containing the bus and switch structures, also contains the three 43.7-kva transformers, a room for a storage battery and the electrolytic lightning arresters for the outgoing 12,000-volt lines.

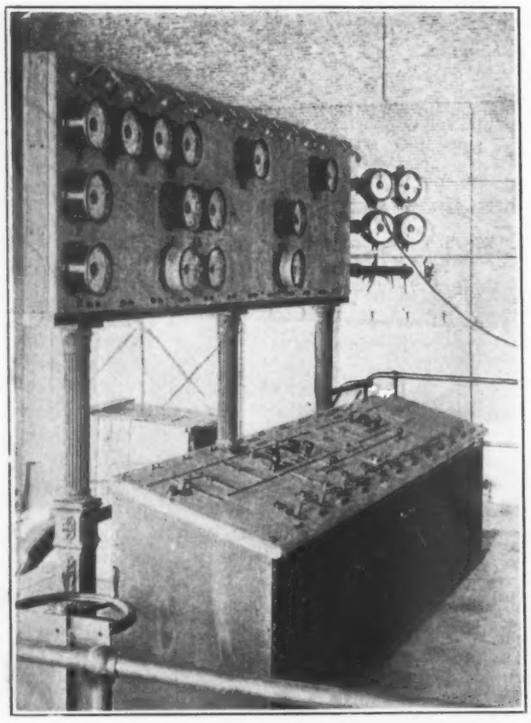


Fig. 3—Control Desk and Instrument Board on Gallery of Generating Station.

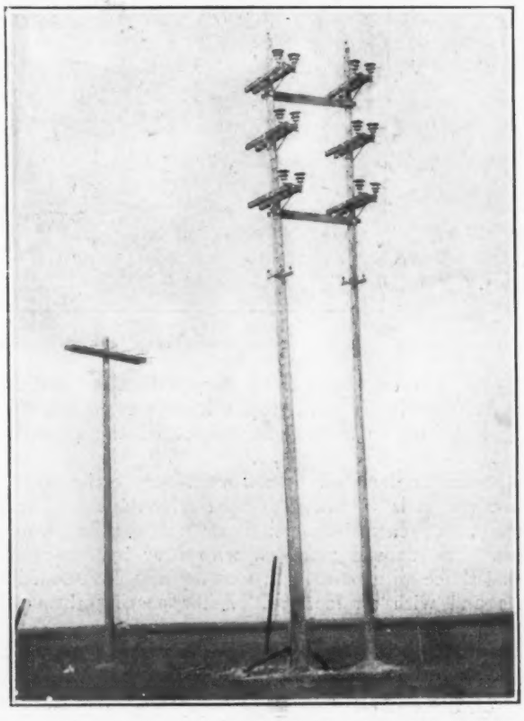


Fig. 5—Crossing Near Calgary and Grounding Net Protecting Government Telephone Line.

The buildings are heated throughout by steam, generated in a boiler in a small annex to the transformer building. Two 5-ft. motor-driven exhaust fans are provided in either end of the generating-room near the roof for summer use.

Oil tanks are provided in a pit below the transformer-room, and the piping is arranged so that the oil from any transformers may be quickly drained into one of these tanks and then filtered and pumped back to the transformer. The cooling water for the transformers is taken from the cross-connecting pipe between penstocks No. 2 and No. 3, there being sufficient head to make pumping unnecessary. A motor-driven Rand air compressor is installed in the basement under the generator-room, and air outlets are provided at convenient places about the building for use in cleaning. The generator rheostat resistances are also located in this basement.

TRANSMISSION LINES.

The transmission lines to Exshaw cross the river in a long span at the power house and run along the north side of the river to the town of Exshaw. This line consists of two three-phase circuits of No. 00 aluminum cable on a single pole line. The poles are of cedar, spaced forty to the mile, the standard length being 30 ft. A steel ground wire is carried along the top of the poles on insulators, and a private telephone line is also installed 4 ft. below the lowest cross-arm.

The transmission line to Calgary is a single-circuit line of No. 0 aluminum cable supported on wooden cross-arms on wooden poles spaced thirty-five to the mile. The standard length of pole is 40 ft. and the standard spacing of conductors is 5 ft. 6 in. Locke insulators were used on this line. A steel ground wire is carried on insulators at the tops of the poles and is grounded at every third pole. A private telephone line is also installed 7 ft. below the main conductors. A second line to Calgary is now under construction, running for the greater part of the way over a separate route. For a short distance both lines will be carried on the same poles, one circuit on each side of the pole on three two-pin cross-arms. Every tenth pole of the transmission line is double-armed, head-guyed and side-guyed, while special constructions are used at angles and railway crossings.

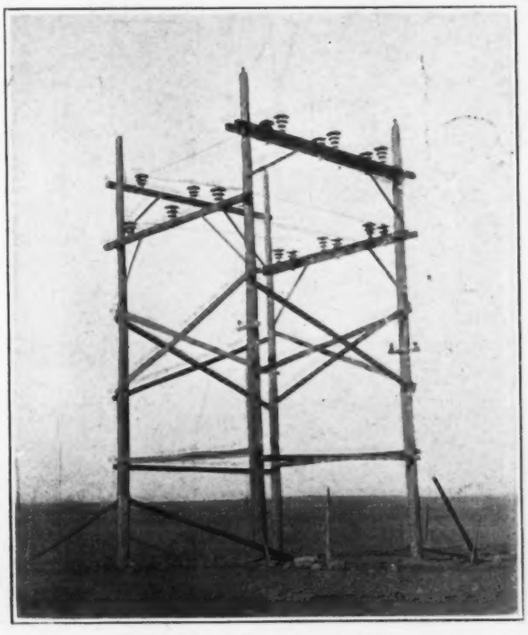


Fig. 6—Structure at Corner on 55,000-Volt Line.

TERMINAL STATION.

The terminal station at Calgary is designed to take care of practically the entire output of the above-described power house, and is also arranged for extension if necessary. The equipment as at present installed consists of two 3000-kva, three-phase, 55,000-12,000-volt transformers, one 3000-kva, three-phase, 55,000-2400-volt transformer and two 1250-kva, three-phase, 55,000-2400-600-volt transformers, with space for one additional 3000-kva unit. The transformers are arranged in a room in separate compartments, with the exception of the 1250-kva transformers, which are both in one pocket. A passageway is provided

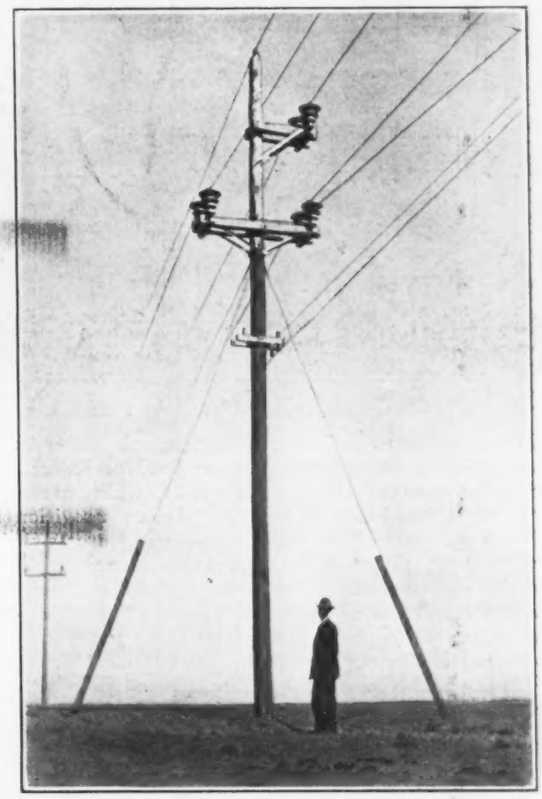


Fig. 7—Standard Double-Armed Pole, Head and Side Guyed.

in front of the transformers with a transfer truck in order to shift the transformers to a position under the chain hoist.

The 55,000-volt lines enter the building through roof inlet bushings and are connected through automatic oil circuit-breakers to the 55,000-volt bus which runs along the rear wall, supported on insulators mounted on a pipe framework. This bus is arranged for sectionalizing through an oil switch, one transmission line being connected to each section. The taps to the transformers on the floor immediately below pass down through large floor openings protected with screens. Disconnecting switches are installed in each tap. The electrolytic lightning-arrester horn-gaps are mounted on the roof, and the tanks are placed in two small rooms along the middle wall of the building.

From the transformers the leaded cables pass to the basement under the front part of the building, thence through the floor to the switch and bus structures on the main floor, from them back to the basement ceiling to the inside of the front wall, and thence up the wall to the line outlets near the roof. Provision is made in the basement for the future installation of feeder potential regulators.

There are three sets of bus structures in the low-tension switchroom. The 12,000-volt bus, although installed as a single bus at present, is arranged for a final double bus. The 2400-volt bus is a single bus and is really a short transfer bus. The 600-volt busbars are mounted directly above the transformer oil switches on pipe framework and the leads pass off from them through knife switches to the line outlets directly behind and above them.

The switchboards are located on the upper floor and are arranged in sections. All the switches are electrically operated and are provided with relays for automatic operation, with the exception of the high-tension bus tie switch. The main switchboard is located along the middle partition wall and controls the incoming lines, the bus tie switch

Fig. 8—Exterior of Calgary Terminal Station.

and the transformer switches. The 2400-volt feeder board is located along the opposite or front wall, the feeder bus-bars being mounted above the switches, which are supported on a framework behind the panels. Provision is made for thirteen feeders. The 12,000-volt feeder switchboard is in the same line as the 2400-volt board and controls the outgoing 12,000-volt feeders, provision for five overhead feeders being made. A station service board is installed on the opposite side of the room with a 5-kw motor-generator set and the service transformers. A storage battery is also installed in a compartment on this floor. The 12,000-volt feeders are provided with electrolytic lightning arresters, while the 2400-volt feeders have the spark-gap type of arrester.

The basement contains the heating boiler, three oil tanks and the cooling-water pumps, which are motor driven. The piping system is arranged similarly to that in the power house, the cooling water, however, being obtained from a reservoir close at hand.

The complete electrical equipment for the terminal station was furnished and installed by the Canadian Westinghouse Company. The switching is so arranged that the future additional 3000-kva transformer shall have a secondary interchangeable for 2400 volts or 12,000 volts, so that it may be switched in as a spare for either service by simply changing the connection on the terminal board inside the case.

EXSHAW SUBSTATION.

The substation at Exshaw contains four 700-kva, three-phase, water-cooled, 12,000-600-volt transformers manufactured by the Allmänna Svenska Electriska Aktiebolaget of Sweden, through its agents, Messrs. Kilmer, Pullen & Burnham, of Toronto, Ontario. The switching equipment consists of a 12,000-volt bus and switch structure controlling the incoming lines and the transformers and a low-tension switchboard with 600-volt bus mounted directly on the panels. A transfer truck is provided for shifting the transformers, and an oil tank with suitable piping arrangements is also installed. This station is designed to supply one customer only, a large cement mill close at hand. The switching equipment here was furnished and erected by the Canadian General Electric Company.

The energy delivered in Calgary from the terminal station is used by the city of Calgary at 2400 volts and 12,000 volts and by the Canada Cement Company at 600 volts in its mills adjacent to the terminal station.

This plant went into operation on May 1, 1911, first supplying energy to the Canada Cement Company's mill at Calgary, and shortly afterward to the city of Calgary. The city uses the energy for the municipal street-railway and electric-lighting service. The Exshaw substation was placed in operation some little time afterward. The load at present is in the neighborhood of 5000 kw.

The engineering firm of Smith, Kerry & Chace, of Toronto, designed and supervised the construction of the entire development.

DELRAY STATION OF DETROIT EDISON COMPANY—II.

14,000-kw Turbo-Generators in Plant No. 2—Special Type of Steam Valve—Electrical Switching Arrangements, Loop Buses, and Substation.

IN last week's *Electrical World* a detailed account was given of the 11,000-kw boilers in the Delray station of the Detroit Edison Company, tables of test data relating to which are reproduced herewith. These results were obtained by Dr. D. S. Jacobus in the course of an extended investigation of the Detroit steaming units equipped with both the rocking-grate and underfeed types of stokers, and were reported by him to the American Society of Mechanical Engineers at its New York convention, Dec. 5 to 8, as noted in these columns Dec. 9 and 16.

STEAM PIPING AND SPECIAL VALVES.

The presence of the few large units in the No. 2 boiler-room has greatly simplified the high-pressure steam piping. Attention should be called, however, to the use of an unusual English form of valve throughout the Delray station. These Hopkinson valves are, in general, of the gate type, but have a total opening of only one-half the diameter, and hence one-quarter the area, of the pipe in which they are inserted, the transition in size being made by a pair

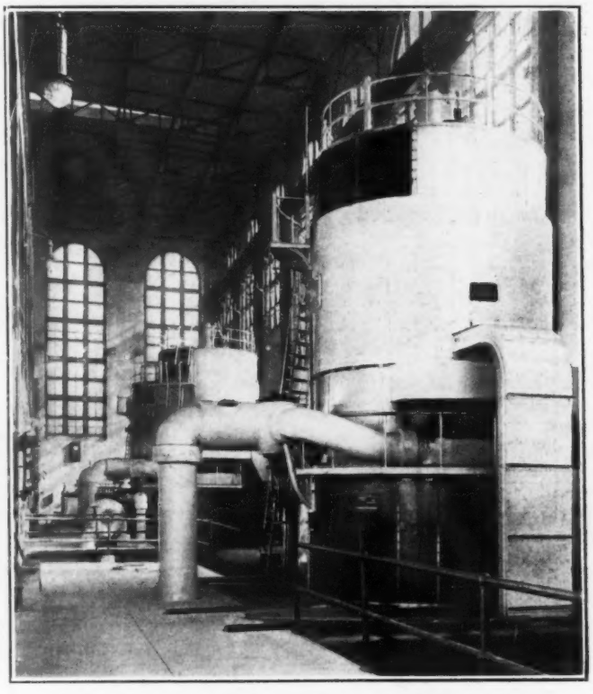


Fig. 10—14,000-kw Turbo-Generators in No. 2 Station.

of opposed cone-shaped funnel chambers in the casting. At the valve the pressure head of the steam is thus in part converted into velocity head for traversing the diminished opening at high speed, again regaining its pressure in the increasing cone chambers on the far side.

For use with steam flows in both directions the valves are

made with two similar cone chambers, while those for unidirectional flow have a short and steep approach chamber and a longer, tapering after-chamber for restoring the pressure head to the steam. These valves are in use at Delray in sizes ranging from 14 in. to 4 in. in nominal dimensions. In the case of some of the 14-in. valves at

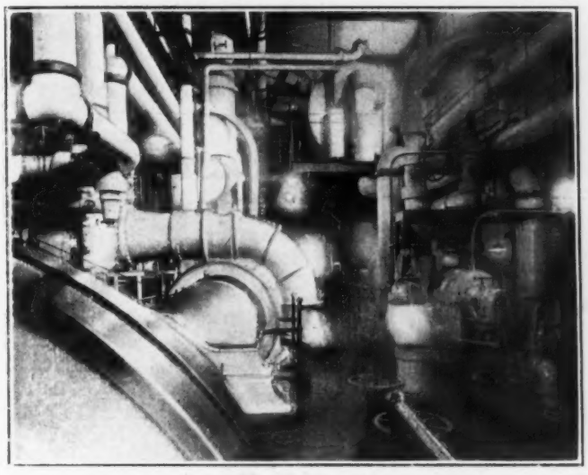


Fig. 11—Pump-Room Containing Auxiliaries of 14,000-kw Turbines.

Delray it has been estimated that the steam velocities at the gate reach 10 miles per minute. The valves have the advantage of affording a direct path for the steam, the gate mechanism when open concealing its own sills so that no eddies are produced in the restricted cross-section. The material of the valves is of a special hard steel which

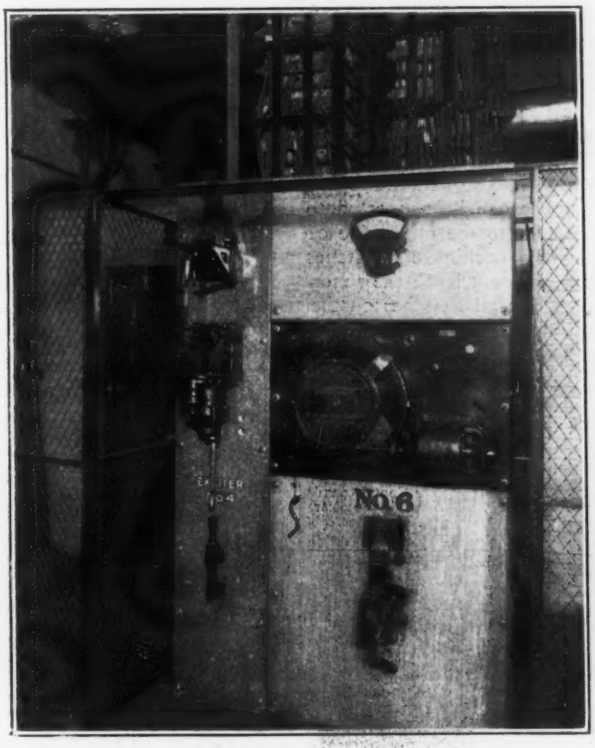


Fig. 12—Remote-Controlled Exciter Panel in Bus Compartment.

resists wear. For operating, the valves are equipped with a gear and pinion, so that one man can manipulate even the largest, the 14-in. size. Aside from their ease of operation and decreased weight, the imported valves, with 40 per cent duty, cost only about three-quarters as much as the ordinary domestic steam fitting.

The No. 1 and No. 2 boiler-rooms are tied together by 10-in., 12-in. and 14-in. steam header lines.

COAL-HANDLING EQUIPMENT.

The coal-handling equipment of the Delray plant is common for the two boiler-rooms. Coal is received by rail,

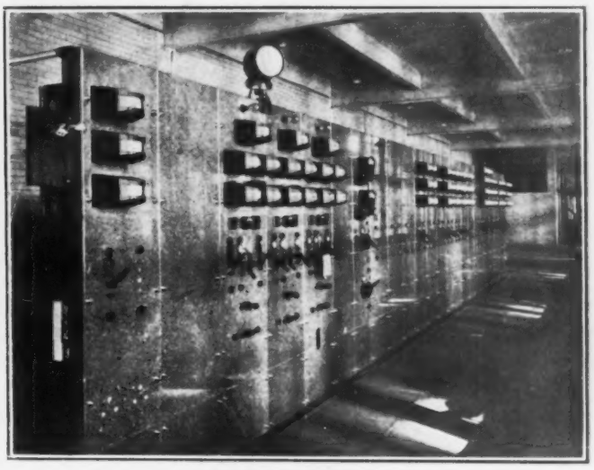


Fig. 13—Control Switchboard.

the cars being delivered to the Delray terminal railroad, which is owned by the Edison company. An inclined trestle raises the dump-bottom cars over the receiving hopper, from which the coal is hoisted by a pair of 2-ton skip hoists to the top of the coal tower. These skip hoists dump automatically into the crusher hoppers from which, after being crushed, the coal is delivered by narrow-gage, cable-drawn cars to the bunkers located over the boilers.

These bunkers are arranged with partition walls and bifurcated spout entries so that different grades of coal may be stored in the two sections, one being used during ordinary loads and the other for the peak periods of the day, in this way utilizing each to its best advantage. The bins of the older boiler-room have a capacity of 5000 tons, and those in the new room one of 3500 tons. Twenty thousand to 30,000 tons are kept in open-ground storage. These piles are reached by the 2 miles of track of the terminal railroad already mentioned, which has two locomotives, four locomotive cranes and a number of cars.

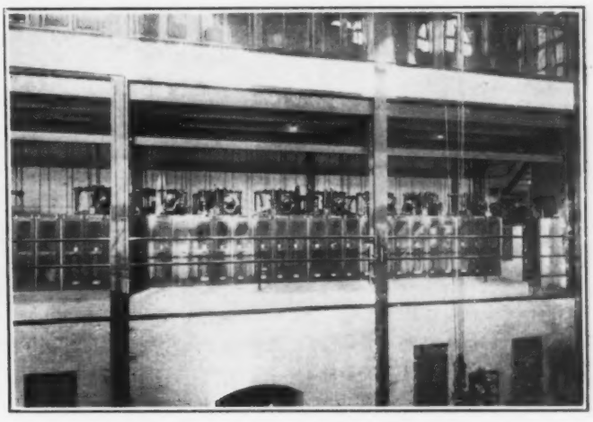


Fig. 14—High-Tension Switch Gallery.

14,000-KW TURBINE-GENERATORS IN NO. 2 STATION.

Three of the four 14,000-kw Curtis turbine units for which the No. 2 plant was designed are already installed. Like the other machines in the No. 1 room, they furnish 4600-volt, 60-cycle, three-phase energy, but run at 720 r.p.m. Steam at 180 lb. per sq. in. pressure, superheated

150 deg. Fahr., is used, the turbines exhausting into 25,000-sq. ft. base-type, two-pass surface condensers. The total weight of one of these 14,000-kw units is about 400 tons, the ten-pole field and revolving part of the turbine alone weighing about 90 tons.

Although ventilated by forced draft, as is necessary in turbo units of this size, these sets are unique in having the hot-well pumps, driven by 35-hp induction motors, are also provided for emergency service.

ELECTRICAL AUXILIARIES, SWITCHING APPLIANCES, ETC.

Exciting current for the large turbo-alternators is supplied by two horizontal, non-condensing Curtis turbines driving General Electric high-speed-type generators. The

TABLE I.—PRINCIPAL DATA AND RESULTS OF TESTS WITH OSCILLATING-GRATE STOKER.

Number of Test.	Length, Hours.	Per Cent Rating.	Heat Units in Coal.	Per Cent Ash in Dry Coal.	Efficiency.	Per Cent Steam Used by Stokers and Jets.	Per Cent Combustible in Ash.	Temperature of Flue Gases, Deg. Fahr.
1	25	105.0	14,362	5.98	77.84	....	19.6	576
2	24	80.0	14,225	6.52	79.88	....	17.9	480
3	24	113.8	14,308	7.40	77.45	0.63	24.4	542
4	30	152.4	13,756	6.54	75.78	1.58	30.8	670
5	24	94.0	13,896	6.89	81.15	1.75	31.6	483
6	24	150.7	14,037	6.13	75.28	[illegible]	26.7	662
16	32	98.6	14,476	9.30	80.98	[illegible]	34.1	460
17	16.5	193.3	14,493	8.24	76.73	1.39	24.6	636
18	24	195.7	13,689	9.81	75.57	[illegible]	23.2	694
2–4†	90	119.8	14,098	6.81	76.13	[illegible]	25.8	572
5–6†	55	127.3	13,977	6.84	76.23	....	29.4	575

†Including periods between tests.

usual direction of the flow reversed, air being taken directly from the engine-room through the 90-deg. apertures shown in Fig. 10 and discharged outside. This arrangement has contributed greatly to the comfort of the engine-room in mild or warm weather, while as a result of the wide inlet opening the cooling effect obtained is practically the same as that from the usual duct intake of limited cross-section. Dampers are provided so that in cold weather the warm air from the turbo-generators can be deflected back into the plant for heating the engine-room.

Water for the condensers of the large turbines is circulated by 36-in. double-suction volute pumps, each delivering 25,000 gal. per minute. The pump engines use 200-lb. steam containing 150 deg. of superheat and exhaust into the open feed-water heaters. The Laidlaw-Dunn-Gordon rotative dry vacuum pumps have each a displacement of 2100 cu. ft. of air per minute. All of the pumps for the No. 2 station, including the two turbine-driven and one motor-driven centrifugal boiler-feed pump, are installed in the pump-room below the turbine floor proper.

Each 14,000-kw turbine has a 10,000-hp Cochrane open feed-water heater receiving the discharge from its hot-well pump and the exhaust of its auxiliaries. In turn each pair of these heaters receives its make-up water through a

150-kw unit runs at 2000 r.p.m. and the 125-kw machine at 2400 r.p.m. The panels for these exciters (Fig. 12) are entirely remote-controlled, the field switches, rheostats, etc., being all located in the bus compartments beneath the oil-switch gallery. The concrete-cell busbar compartments and oil switches of both plants are situated on their first mezzanine galleries, the second galleries being occupied by the control [illegible] switchboard generator panel is equipped with two wattmeters, one voltmeter, one ammeter, one field ammeter, one governor-controlling switch, one rheostat-controlling switch, oil-switch control contacts and a watthour meter.

The 4600-volt bus for each station is arranged in the form of a loop closed across its ends by tie oil switches and broken into two halves by sectionalizing switches. This gives the advantage of a double bus without its duplications. The generators are so arranged that part of the number can be connected to one bus section and the remainder to the other side of the loop. In addition to the regular machine oil switches and disconnects on the bus-compartment level, the generator leads are brought through auxiliary oil switches on the floor below, insuring positive rupture of the circuit in case of the failure of the main switches. The loop buses in each power house are con-

TABLE II.—PRINCIPAL DATA AND RESULTS OF TESTS WITH UNDERFEED STOKER.

Number of Test.	Length, Hours.	Per Cent Rating.	Heat Units in Coal.	Per Cent Ash in Dry Coal.	Efficiency.	Per Cent Steam Used by Stoker Auxiliaries.	Per Cent Combustible in Ash.	Temperature of Flue Gases, Deg. Fahr.
7	24	151.2	14,000	7.03	77.07	2.61	31.5	575
8	24	107.9	13,965	6.34	80.28	2.44	27.1	493
9	50	162.8	13,998	6.75	77.85	2.87	31.3	574
10	48	92.9	14,188	9.90	77.90	2.63	27.2	487
11	26.5	211.3	14,061	9.55	75.84	3.41	36.1	651
12	48	121.3	14,010	8.09	79.24	2.57	27.6	535
14	24	185.5	14,272	8.71	76.42	2.95	28.8	647
7–9†	109	140.0	13,983	7.22	77.66	2.68	30.0	545
10–11†	80.5	132.8	14,095	9.58	75.66	3.04	31.1	542

†Including periods between tests.

common heater of the same size, which acts to pre-warm the incoming raw water (taken from the hot-well which receives drips), boiling off its dissolved air and precipitating its impurities. These joint make-up heaters discharge automatically into the pairs of main heaters below.

The hot-well pumps are of the two-stage centrifugal type and are driven by 25-hp steam turbines. Auxiliary

nected together by tie switches and the two plants operated as a single system at all times.

The number of 4600-volt trunk lines and feeders radiating from Delray to the various substations of the system are tapped off the main bus loops through motor-operated oil switches similar to those for the generator units. Each feeder panel is equipped with wattmeters,

ammeters, watthour meters and oil-switch controlling contacts.

The generated pressure of 4600 volts was, however, found rather low for transmitting to the distant north and west parts of the city, a higher voltage being also required

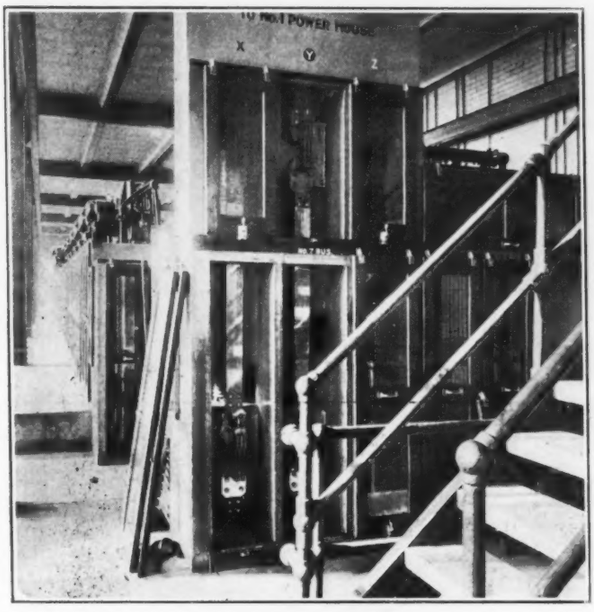


Fig. 15—Busbar Gallery of No. 2 Station.

for the long distances over which Delray energy is delivered to customers of the Eastern Michigan Edison Company in the suburban territory surrounding Detroit.

The step-up transformers for this purpose are installed in a substation 500 ft. north of the Delray power houses. This station contains six 3000-kw, three-phase air-blast transformers, with 4600-volt primaries and 22,000-volt secondaries. As the 22,000-volt load had increased with the parts of the system undergoing the most rapid growth, it soon became evident that a large number of trunks would be required between the station buses and this nearby substation. To save this duplication of cable lines, it was decided to extend the plant buses themselves directly to the substation, and from them at that point oil switches similar to those already mentioned will tap off to the transformer units. The bus extension is carried on the steel bridge structure between the plant and substation shown in Fig. 16. When completed, as it soon will be, this bus will thus save the installation of numerous present and future short cable trunks and their switches. The 22,000-volt lines are carried from the substation in underground cable.

In addition to the step-up transformers, switches and aluminum-cell lightning arresters, the substation contains one 1000-kw and one 500-kw motor-generator set for supplying 600-volt railway direct current, and the switchboard and regulators for the local 2300-volt, single-phase, and 4600-volt, three-phase circuits.

The operating roll of the Delray station numbers 200 men, while at the present time 200 others are employed on construction work under the direction of the operating staff. For the benefit of its men at Delray the company has just installed an attractive restaurant, where each day

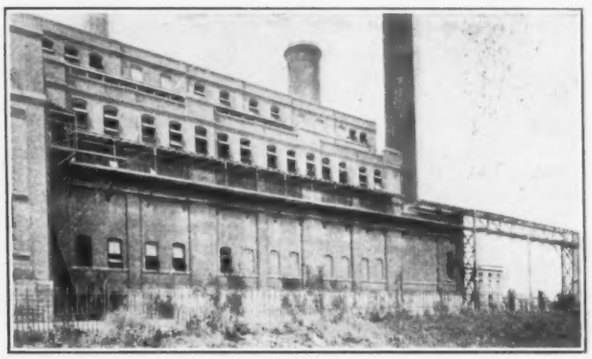


Fig. 16—Steel Bridge Carrying Bus Extension to Substation.

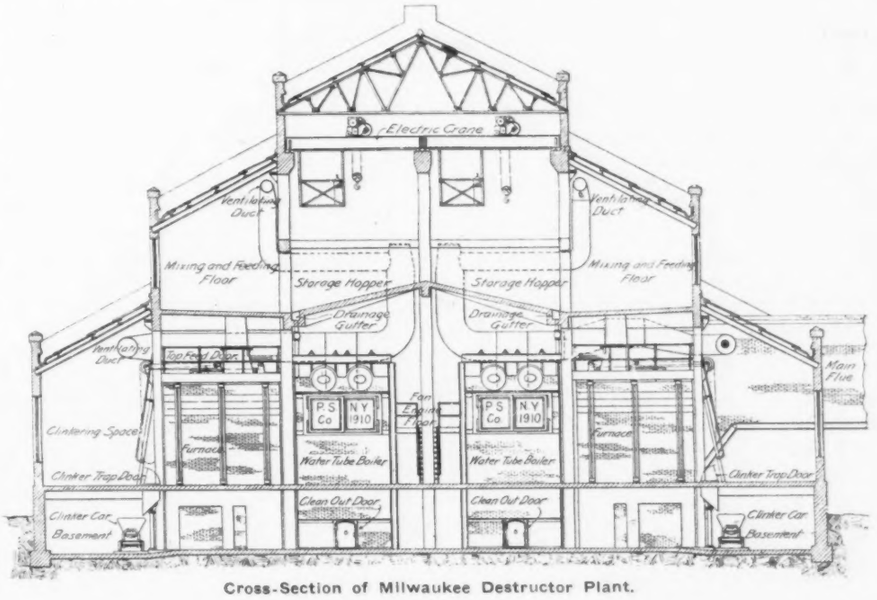
about 300 meals are prepared on an electric range and served to employees at cost.

Mr. Alex. Dow is general manager of the Edison Illuminating Company of Detroit, and Mr. B. J. Denman is acting chief engineer of the Delray station.

MILWAUKEE CITY GARBAGE ELECTRICAL PLANT.

The city of Milwaukee is now installing a 600-kw turbo-alternator to use steam from its garbage destructor plant on the lake front, the electrical output of this machine to drive the huge screw pumps which flush the Milwaukee and Kinnickinnic Rivers. The garbage destructor was erected eighteen months ago, and the turbine installation will be completed by April, 1912.

The flushing pumps are at present engine-driven. These



Cross-Section of Milwaukee Destructor Plant.

engine units will be replaced by 350-hp motors energized over 4000-volt, 60-cycle, three-phase transmission lines from the garbage plant. The pump discharging into the Milwaukee River is capable of raising 500,000,000 gal. of lake water per day, through a height of 3 ft. This pumping station is 4 miles distant from the power plant. The

Kinnickinnic station, about 1 mile distant, contains a 435-r.p.m. screw pump almost equal in size to the Milwaukee River pump. To secure interchangeability of parts this pump will be similarly driven by a 350-hp motor.

Steam from the destructor boilers has been hitherto wasted by blowing into the atmosphere, except for some small auxiliary service in two 50-kw engine-driven sets used to operate the plant cranes and hoists and for lighting. With the addition of a small quantity of coal to smooth out the irregularities in the steam-output curve, about 19,000 lb. of steam is available each hour. The 600-kw Allis-Chalmers turbine will use steam at 135 lb. pressure, and will exhaust into a Le Blanc jet-type condenser. The new power-generating equipment is being installed in an addition to the destructor plant. Near by it is also planned to erect a fuel-burning power house to contain two 1600-kw turbines to furnish energy for the city's street lighting, the 4000-volt, 60-cycle garbage-plant equipment being operated in connection with this lighting system.

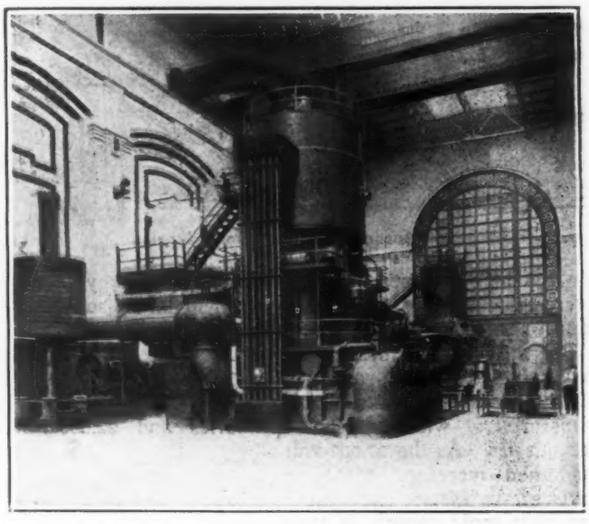
The run-of-refuse fuel used in the incinerating plant comprises a mixture of household ashes, manure, garbage and rubbish, which is sorted into bins and dried preparatory to mixing it into proportions for firing to the special furnaces. The ordinary household cinders and ashes contain 18 to 25 per cent carbon and have a fuel value of about 3700 lb.-Fahr. heat units per pound. Manure consists of 25 per cent carbon and 25 per cent volatile matters, and contains 2700 heat units per pound. Garbage has 8 per cent of combustibles and contains 2000 heat units. Rubbish contains 25 per cent carbon and 5000 to 7500 heat units per pound. Garbage makes up the principal refuse material in summer, and ashes in winter, the mixed material as fed to the furnaces averaging 3000 to 3350 heat units per pound. The furnaces are supplied with air at 300 deg. and maintain temperatures of about 1500 deg., evaporating 1.1 lb. of water per pound of refuse.

THE LARGEST CENTRAL-STATION TURBINE IN NEW ENGLAND.

THE Edison Electric Illuminating Company of Boston is now operating in regular service the largest central-station turbine in New England, the machine being rated at 15,000 kw and located at the south end of the principal generating plant of the company, at L Street, South Boston. The new unit is a six-stage vertical Curtis machine, direct-connected to a ten-pole, 7000-volt General Electric revolving-field, 60-cycle, three-phase alternator, and it is the sixth machine of this general type to be installed in the station. The L Street plant is now equipped with turbo-alternators aggregating 66,000 kw in capacity, besides 9000 kw in vertical cross-compound engine-driven alternators. A view of the new unit is shown in the accompanying photograph.

The turbine and its auxiliaries are supplied with steam from eight 512-hp Babcock & Wilcox boilers, the operating steam pressure being 200 lb. and the superheat about 150 deg. Fahr. The boilers are newly installed and are fired by Murphy automatic stokers. The machine delivers current to three Y-connected compensators rated at 2500 kw each, which step up the potential to 14,000 volts for delivery to the station busbars connected with the transmission of energy to the more distant portions of the Edison system. The turbine is equipped with a base condenser of the Worthington surface type, having about 22,500 sq. ft. of cooling surface and supplied with circulating salt water by a 36-in. volute centrifugal pump direct-driven by a vertical Atlantic engine. The speed of this pump is varied from about 150 r.p.m. to 200 r.p.m., depending upon the temperature of the circulating water. This varies from about 30 deg. to 70 deg. Fahr., depending upon the season. The pump is of the horizontal type, and enables the company to secure economy in space by its combination with a vertical direct-connected driving engine. The other principal auxiliaries include a duplex 14-in. x 3½-in. x 18-in. step-bearing pump, a 12-in. x 31-in. x 24-in. combination horizontal and vertical Laidlaw-Dunn-Gordon single-cylinder reciprocating dry vacuum pump, a 26-hp centrifugal 5-in. wet vacuum pump direct-driven by a Curtis turbine, a Goulds triplex oil pump gear-driven by a 7½-hp General Electric 550-volt induction motor, a Kinney jacket water pump of 600 gal. per minute capacity driven by a 5-hp induction motor, a 4-in. centrifugal boiler-feed pump and two accumulators for step-bearing service. Water is used on the step bearings of all the turbines in the L Street station.

The new turbine was placed in service for the first time on Sept. 26 of the present year. The turbine section of the plant comprises separate fire-rooms for every three batteries of boilers and separate turbine-rooms for every four turbines, it being the intention to extend ultimately the building to accommodate twelve units of 12,000 kw or



15,000-kw Turbo-Alternator in Boston Edison Station.

greater capacity. Three 12,000-kw turbines and two 5000-kw units, maximum rating, are now in service besides the 15,000-kw equipment, and the original engine-driven plant is used only in handling peak service for short periods during the fall and early winter season. In the newer section of L Street a separate building is provided for the installation of motor-driven switching apparatus of the most modern design, located in fireproof compartments with barriers and other suitable separating devices in all positions where there is any possibility of dangerous conditions arising. With the increase in output rating of generating units it became necessary to abandon manually controlled switching apparatus. All the instruments and control switches are now located in a centralized operating-room, from which the energy supplied throughout about 600 sq. miles covered by the company's territory is controlled. In connection with the extension of service to points lying from 20 to 25 miles from Boston three three-phase water-cooled transformers have lately been installed to enable the earlier machines to be operated on the 14,000-volt bus. These units are rated at 5882 kva each, and are located in a compartment also containing the compensators connected in the phases of the 15,000-kw turbine.

The greater portion of the company's output is now handled by the turbines at L Street, only a small percentage being produced by engine-driven generators at L Street and in the old Atlantic Avenue station in Boston proper.

THE GENERATING AND TRANSMISSION SYSTEM OF THE TELLURIDE POWER COMPANY—V.

Transmission Lines of the Utah System Aggregating 541 Miles Carried on Wooden-Pole Towers—System Designed for Operation at 88,000 Volts—Aluminum Conductors Used in Part.

IN these columns have previously been described the Colorado system of the Telluride Power Company and the various generating stations of the Utah system. The following account of the transmission lines of the Utah system, including a description of the pole-line and tower construction and substation data, forms the conclusion of the series of articles describing the pioneer high-tension transmission system of the world.

TRANSMISSION SYSTEM, UTAH DEPARTMENT.

The general arrangement of the transmission system, which consists entirely at present of 44,000-volt, three-phase lines, comprises two trunk lines carried on separate pole or tower structures from the Grace generating station in Idaho through the Logan station in Utah and thence southward through the outskirts of Salt Lake City to Jordan Narrows. From Jordan Narrows a loop line is carried westward through Bingham and Garfield to the Salt Lake switchrack, a cross-connection also being made from an open-air switching point at West Jordan direct to Bingham. South of Jordan Narrows one line is carried to Olmsted station by way of Battle Creek and a second by way of Lehi. From Olmsted southwest a loop line is run through Provo, Benjamin, Eureka and Topliff to Mercur, returning to Lehi by way of Cedar Fort. Between the latter point and Bingham a high-tension tie circuit is in service. The principal market of the company lies in the district including and south of Salt Lake City, and in general between the southern borders of Great Salt Lake and Utah Lake. Salt Lake and Jordan Narrows are the two principal centers of high-tension distribution, and, as stated above, the Logan and Olmsted stations are the principal regulating stations.

HEADQUARTERS.

The operating headquarters of the system are at Olmsted, a load dispatcher being on duty at all times and responsible for the maintenance of continuous service, regulation, apportionment of loads between stations, inter-switching of transmission lines and repairs. About 400 miles of metallic circuit telephone lines are required for the service of the company, and in general these lines are carried on about 220 miles of pole lines separated from the transmission system. Simultaneous telephony and telegraphy are operated on important trunk lines. Connections with the local Bell system are maintained throughout the property. In no case does the company permit the location of telephone and transmission circuits on the same supporting structure.

The total length of transmission lines on the Utah system aggregates 541 miles, nearly half of this being covered by two parallel trunks extending 128 miles from Grace station to Salt Lake. It is planned to operate these trunks at 88,000 volts at a later period. Steel-tower, wooden-tower and pole lines are employed on the system, about 75 per cent the total length of transmission service being of the last-named type. Steel-tower and wooden-tower lines have been used by the company for about two years, and the various types of pole line employed range from the early designs placed in service in 1898 to the types standardized in the last three years.

STANDARD POLE-LINE CONSTRUCTION.

This consists of a wooden pole from 30 ft. to 50 ft. long, according to conditions, the regular height being 35 ft. over all and the height above ground 30 ft. The pole is 8 in. in diameter at the top, the cross-arm 7 ft. long and the conductor spacing triangular, with separation of 72 in. The approximate height of the lower conductors above the ground is 25 ft. The cross-arm braces are of wood, 3 ft. 4 in. long. Cross-arms are framed around the pole, the ends being bolted to cobble blocks and the whole arm being treated to give additional insulation. The standard span is 300 ft., and each pole is equipped with a No. 9 iron ground wire attached to a clamping ring at the top and run to the bottom of the pole, the lower end being wrapped around the pole butt three times and stapled. Paraffined locust pins 3 in. in diameter and 22.7 in. long are used, these being fitted into the pole tops and secured by machine bolts and fitted into cross-arm pin blocks and bolted through. From a point 2 ft. above the surface of the ground to the butt end the pole is treated with carbolineum. In the company's earlier work solid wooden cross-arms were employed, with "Provo" glass insulators and spans of from 120 ft. to 200 ft. The insulators on the standard pole line are three-part Locke units, 12 in. in diameter.

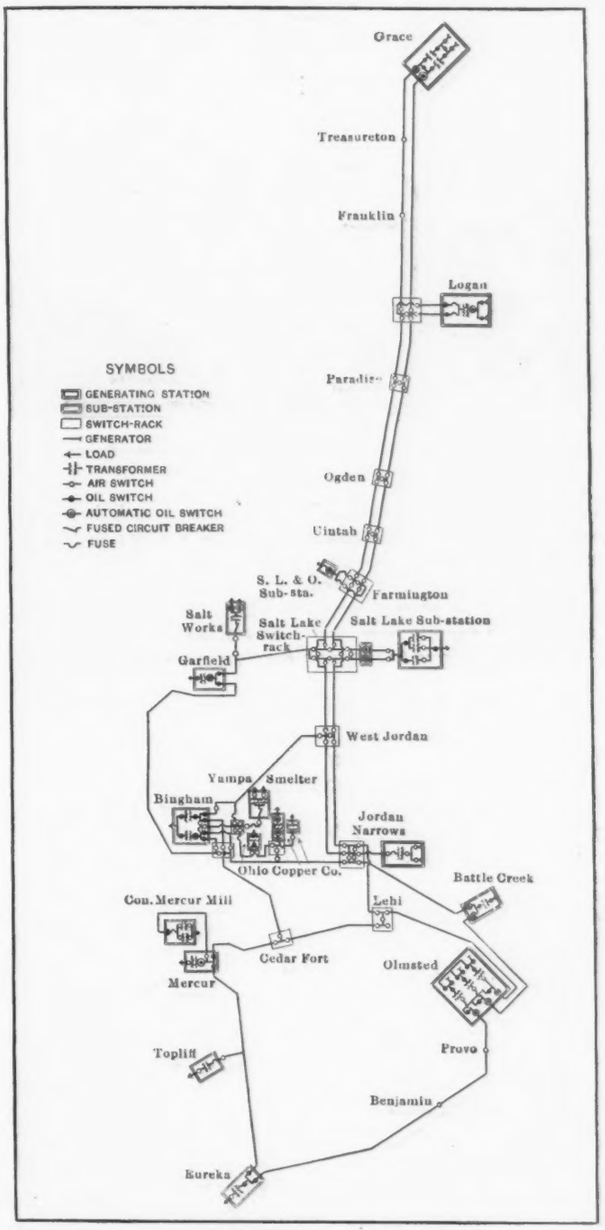


Fig. 35—Diagram of Utah System.

WOODEN-TOWER CONSTRUCTION.

This type of line consists of an H-frame formed by two 50-ft. poles of Idaho cedar, the phase wires being carried in a horizontal row and spaced 11.5 ft. apart, this also being the separation of the poles. The latter are tied together by

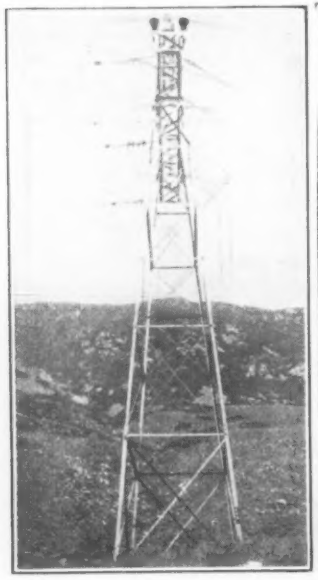


Fig. 36—Dead-ending Steel Tower.

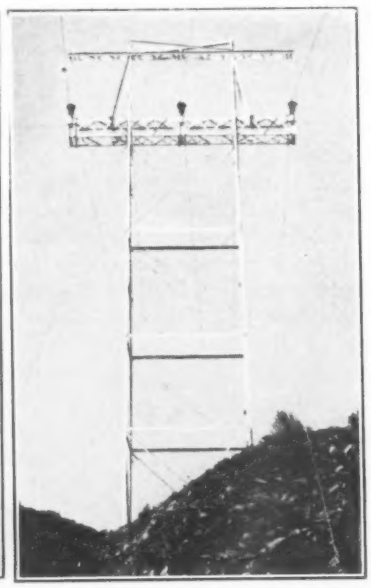


Fig. 37—Steel-Tower Construction.

a 24-ft. framed cross-arm of treated timber, cobble blocks being used to carry the insulators in the manner described under the standard pole-line construction. Eight-inch poles are used, and each is capped by a lightning rod about 5 ft. long, with ground wire on each pole. The butts are treated with preservative, and four wooden braces are used. The normal span is 600 ft. and the height above the ground 40 ft.

STEEL-TOWER CONSTRUCTION.

Rectangular towers built of steel are employed, the height being 57 ft. and the conductor spacing 12 ft., all wires being carried in a horizontal plane about 50 ft. above the ground. The standard span is 900 ft., and the tower members are galvanized, the foundation being of concrete, steel or wood, according to local conditions. The pins are of paraffined wood, 25 in. long and 4 in. in base diameter, the same type being used on the wooden tower lines. The insulators are Locke three-part units, as described above. At the top of each tower a truss has been installed, with lugs for the attachment of suspension insulators, in case these are used in the reconstruction of the line for 88,000-volt service. The steel-tower construction extends from Salt Lake to Farmington on the west trunk line and from Farmington to Ogden on the east line. The standard conductor used on the steel-tower lines is stranded copper of 8 per cent larger area than No. 0, the cable being attached to the insulators by double ties of No. 2 copper. Provision has been made for raising the cross-arms on wooden towers when suspension insulators are installed for 88,000-volt operation.

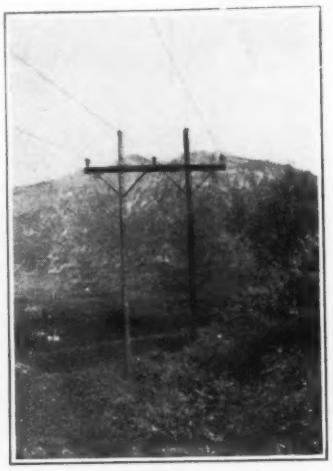


Fig. 38—Wooden-Tower Construction.

OUTLINE OF LINE CONSTRUCTION.

The Grace-Logan transmission trunk lines were completed in 1909 and are pole lines from end to end, with 10-ft. cross-arms, the section from Logan to Salt Lake being of steel and wooden-tower construction. The conductors on these lines are cable of seven strands No. 8 copper, seven strands No. 6 aluminum and No. 2 solid copper. The Olmsted and Jordan Narrows lines are of standard pole type, No. 2 copper, No. 5 copper and No. 2 aluminum cable being used. These lines are from 19 miles to 22 miles long. The Bingham-Garfield line is of standard-pole construction, No. 2 solid copper being used, and No. 4 copper is used on one line between Salt Lake and Jordan Narrows, the other being strung with No. 2 aluminum cable. The Eureka-Mercur lines are of the early wooden-pole type, No. 2, No. 3 and No. 00 aluminum cable and No. 5 copper being employed. The principal lengths of line on the southern section of the system are, besides those given above: Salt Lake to Jordan Narrows, 21.4 miles; Salt Lake to Garfield, 11.8 miles; Garfield to Bingham, 22.8 miles; Bingham to Jordan Nar-

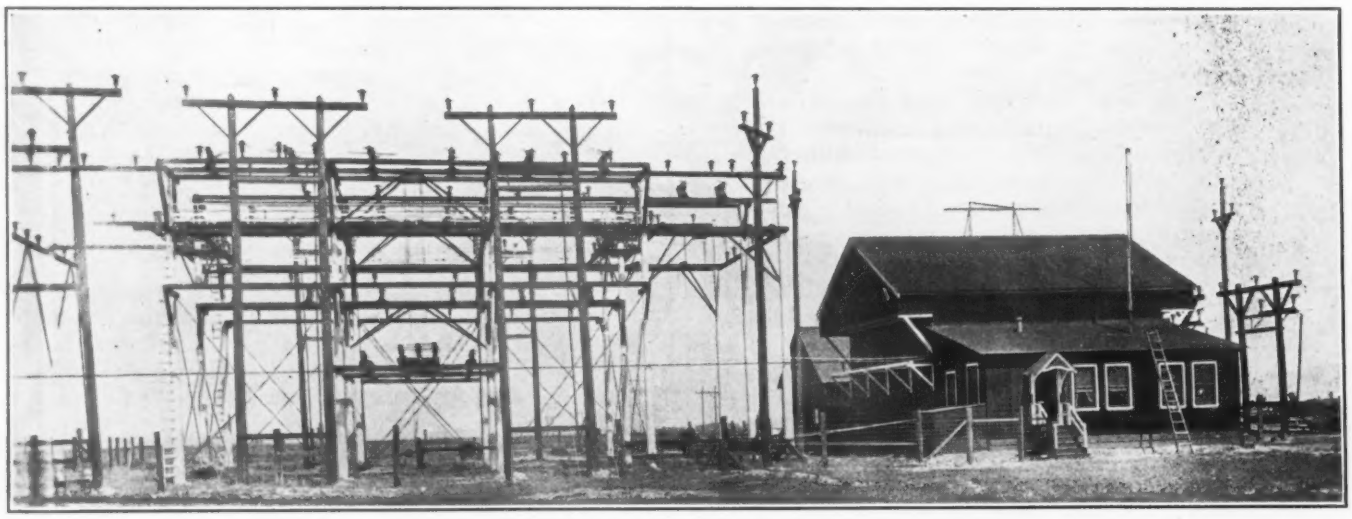


Fig. 39—Switch Rack at Salt Lake.

rows, 11.5 miles; Lehi to Mercur, 17.1 miles; Bingham to Cedar Fort, 13.8 miles; Mercur to Eureka, 27.6 miles, and Eureka to Olmsted, 40.6 miles.

SALT LAKE SWITCHRACK.

The switchrack of the company in the suburbs of Salt Lake City is one of the largest in the world, being about 90 ft. long, 60 ft. wide and 45 ft. high. It is built of treated timber, the principal members being 6 ft. x 8 ft. x 20 ft. in dimensions. From this rack two lines radiate to Grace station, two to Olmsted by way of Jordan Narrows and two to Garfield. All lines can be cross-connected or paralleled, as the conditions require. Sixteen open-air rotary switches are installed, all being controlled by levers, wires or rods

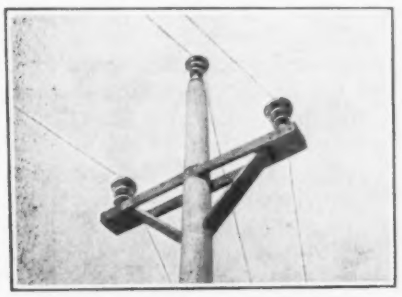


Fig. 40—Wooden-Pole Construction

mounted in the adjacent substation after the manner of a railroad signal tower. The substation is a temporary structure, containing two automatic oil switches of the 45,000-volt type, controlling two three-phase lines feeding the system of the Utah Light & Railway Company through a substation belonging to the latter organization located on the Jordan River in the east part of Salt Like City. Series and shunt-instrument transformers, choke coils and electrolytic lightning arresters are installed in the Salt Lake substation.

SUBSTATIONS.

The low-tension distribution of the company is handled through various substations, some of which are owned by consumers and others by the Telluride organization itself. In general, the substations are provided with high-tension oil switches, choke coils and electrolytic lightning arresters. The principal data are shown in the following table:

Substation.	Dimensions. in Feet.	Building Material.	Main Transformers, Kilowatts.		Notes.
Salt Lake	33 x 38	Cor. Iron.	None.		Control and metering point.
Salt Lake	.....	Brick and Concrete.	6	333	Owner Utah Light & Ry. Co.
			3	500	
Bingham	58 x 62	Cor. Iron.	8	1000	26 miles 5000-volt distribution.
Mercur	25 x 50	Brick.	4	100	8 miles 5000-volt distribution.
Topliff	18 x 22	Cor. Iron.	4	100	2.5 miles 5000-volt distribution.
Eureka	28 x 40	Brick.	4	250	11 miles 5000-volt distribution.
Garfield	60 x 70	Rein. Con.	4	1000	Owner Boston Con. Mining Co.
I. C. Salt Co.	18 x 20	Brick.	3	125	Owner Inland C'st'l Salt Co.
Logan	17 x 25	Brick.	3	50	Local 2300-volt and 5000-volt service.
Provo	16 x 16	Cor. Iron.	3	250	5000-volt Electric Co. of Provo.
Farmington	.....	Brick.	6	150	Owner S. L. & O. Ry. Co.
S. L. & O. Ry.	.....	.....	.....		Three 450-kw substations supplied through Farmington substation.

Automatic oil switches of the inverse-overload, time-limit type are installed in the high-tension circuits at Grace, Olmsted and Battle Creek generating stations and at the Salt Lake, Garfield and Bingham substations.

The officers of the Telluride Power Company are: President, Hon. Andrew Squire, Cleveland, Ohio; vice-presidents, Messrs. O. M. Stafford, Cleveland, and C. D. Walcott, Washington, D. C.; general manager, Mr. L. L. Nunn, Provo, Utah; chief engineer, Mr. P. N. Nunn, Provo, Utah.

EXPERIMENTS WITH ELECTRIFICATION DURING GROWTH OF GARDEN AND GREENHOUSE PLANTS.

THE interesting possibility of planting corn on land from which the crop of winter wheat has been gathered in July, and then stimulating the growth of this corn by electrical means so that it will fully mature before cold weather, has been suggested as a means of

Fig. 1—Network of Charged Wires Over Acre Plot.

doubling the productiveness of a given acreage by Mr. William Stahl, of Evanston, Ill., who has planted corn successfully as late as July 25, during a series of experiments conducted by him with the electrification of growing crops near his home at Evanston. Several local newspaper accounts have referred, with various degrees of accuracy, to Mr. Stahl's experiments, which are being carried out with the assistance of a practical florist and gardener, Mr. Richard Gloede, and both gentlemen testify to the increased healthiness, shortened growing period and resistance against drought shown by the electrified plants.

An unidirectional potential of about 250,000 volts is used in these experiments. The initial work was done with a

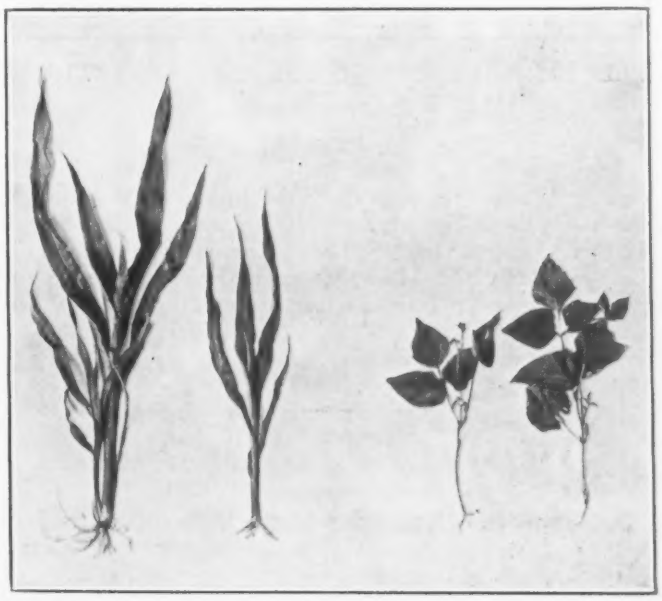


Fig. 2—Comparison of Electrified and Ordinary Plants. Corn and Beans Planted July 25, Taken Up Aug. 18.

static machine, but this was found to give trouble from mechanical causes and failure to generate during periods of humidity. Central-station service from the 60-cycle lines of the North Shore Electric Company is now used, being stepped up to approximately 250,000 volts by a high-tension

coil and then rendered into direct form by a mechanical rectifier driven by a small synchronous motor.

A network of wires 2 ft. to 3 ft. apart is mounted at a height of about 8 ft. above the acre of ground selected for the tests. On this plot were planted a great variety of vegetables, including Indian corn, popcorn, tomatoes, cantaloupes, cucumbers, eggplant, lettuce, radishes, onions, peppers, cauliflower, cabbage, carrots, etc. Although planted late, these vegetables, according to Mr. Stahl, came through a severe drought much better than similar unelectrified plants and reached maturity in a period much less than the usual time. The potential was turned on the plot only from two to six hours daily, morning and evening, during hot, dry weather, although for longer periods when the air was moist. The energy consumption was almost negligible, it appears, for, although no indicating instruments were used, the electricity bills averaged only $2 to $3 per month during the treatment of the acre.

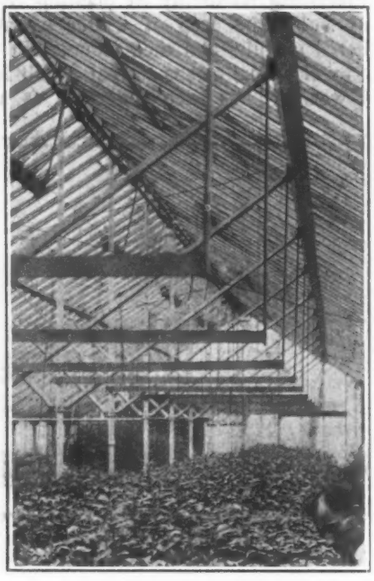


Fig. 3—Arrangement of Network in Greenhouse.

As an example of the superior growing power of plants when subject to electrification, the experimenters report that even newly laid sod along pathways through the acre plot was found to thrive and grow green, while during the dry weather that was being experienced at the time the old, rooted grass at other parts of the grounds was burned badly. Mr. Stahl also asserted that the electrification tends to kill fungus growths which often attack greenhouse vegetation. As to the manner in which the presence of the electric field acts to stimulate the growth of plants he attempts no explanation. The large size and excellent quality of radishes, tomatoes, melons, beets, corn and other garden products have convinced the experimenters, however, that they are following on the trail of a well-defined law of plant growth.

The same scheme of electrification has also been applied to greenhouse benches, a network of high-tension wires being suspended on insulators at a height of 50 in. above the beds, while a ground wire is buried in the earth of the boxes. According to Mr. Stahl, this greenhouse electrification has resulted in growing much larger and fuller chrysanthemums, etc. Electrification treatment, he adds, is found to open gladiolus bulbs in thirty-six hours, which ordinarily require a week. Experiments on an enlarged scale will be carried out at the Evanston plot during the coming season, while the greenhouse installation will be in use all winter to accelerate flower growth under artificial conditions.

Central Station
Management, Policies and Commercial Methods

ELECTRIC HEATERS TO PREVENT FREEZING OF WATER PIPES.

The New York Edison Company has just supplied five electric heaters which will be used to prevent freezing of water pipes in one of the loft buildings owned by the Trinity Corporation. Four of these heaters are of the 1200-watt size, and will be placed under the pipes leading from the roof tank to the house supply system, and the other, an 800-watt heater, will be set in the pump-room. Thermostatic control is included.

THEFT OF ELECTRIC-SIGN LAMPS.

The Louisville (Ky.) offices of the Federal Electric Sign System, as well as the owners and operators of electric signs throughout that city, are suffering considerable loss from the depredations of incandescent-globe thieves, and every effort is now being made by the Louisville police department to break up the practice of stealing globes from signs throughout the city.

A big sign maintained by the Federal Electric system at Second Street and Broadway has been peculiarly the prey of miscreants, several dozen bulbs having been carried off from the structure within the past week. Inasmuch as the lamps cost anywhere from 60 cents apiece upward the loss of a score or so at one swoop constitutes a noticeable item in the expense of upkeep of the sign for the company.

"We believe that misguided youngsters about the city are the cause of the lamp thefts," said Mr. R. A. Brian, of the Federal system in Louisville. "One or more of these youthful burglars shins up the framework of the sign and drops incandescent lamps to his comrades below. The police have a hard time coping with the juveniles, so we are figuring upon the preventive method of erecting the signs upon such a high framework that ordinary climbing efforts will be defied. That will mean considerable extra cost for installation, but we are obliged to put a stop to our losses from theft."

CONTRACT ORDER ROUTINE.

In large electric-service companies where a formidable number of contracts, orders, discontinuances and changes have to be handled every day the routine of handling this large volume of business becomes of considerable importance. It is of interest to note that the Commercial Section of the National Electric Light Association has appointed a committee, known as the contract order routine committee, to make a study of this subject and point out if possible where a saving of time may be effected in handling a large volume of routine work of this character.

Mr. T. I. Jones, of the Edison Electric Illuminating Company of Brooklyn, is chairman of this committee. A recent change has been put into effect in the contract department of the Commonwealth Edison Company of Chicago by which the work of handling contract orders is expedited to a marked degree. An effort is now made to give service to a new customer on the day on which the order is placed, provided the company's mains are on the street where the customer's premises are located. This is done by waiving an examination into the credit of the applicant where the company has good reason to believe that the new customer is a reputable person. The connection is made at once, and the investigation as to credit, requirement of a deposit, etc., is made afterward. In a very few cases it is found necessary to discontinue the service, but the percentage of unsatisfactory customers secured by this quick-order method is very small.

COSTS OF OPERATING INTERNAL-COMBUSTION-ENGINE PLANTS.

At the recent meeting of the American Society of Mechanical Engineers at New York Mr. H. R. Setz, of Warren, Pa., presented figures comparing the operating and investment costs of various types of internal-combustion-engine plants. These figures consider the load at which the equipment is operated, on a basis of 4500 hours per year.

STATISTICS OF INTERNAL-COMBUSTION-ENGINE PLANTS.

	GAS PRODUCER PLANT.			NATURAL-GAS ENGINE.			LOW-PRESSURE OIL ENGINE.			DIESEL ENGINE.		
	Load.	Three-quarter Load.	Half Load.	Load.	Three-quarter Load.	Half Load.	Load.	Three-quarter Load.	Half Load.	Load.	Three-quarter Load.	Half Load.
1 Fuel per hp-hour	1.25 lb.	1.5 lb.	1.8 lbs.	10 cu. ft.	12 cu. ft.	15 cu. ft.	1 lb.	1.25 lb.	1.6 lb.	0.50 lb.	0.55 lb.	0.60 lb.
2 Fuel per hp-year (4,500 hours)	2.5 tons	3 tons	3.6 tons	45,000 cu. ft.	54,000 cu. ft.	67,500 cu. ft.	643 gals.	803.5 gals.	1028.5 gals.	321.5 gals.	353.5 gals.	386 gals.
3 Cost of fuel	$4.00 per ton			30 cents per 1000 cu. ft.			3 cents per gallon			3 cents per gallon		
4 Cost of fuel per year	$10.00	$12.00	$14.40	$13.50	$16.20	$20.25	$19.30	$24.10	$30.85	$9.65	$10.60	$11.58
5 Cost of attendance per hp-hour	0.40 cent			0.25 cent			0.25 cent			0.30 cent		
6 Cost of attendance per year	$18.00			$11.25			$11.25			$13.50		
7 Lubricating oil per hp-hour	0.006 pint			0.006 pint			0.006 pint			0.007 pint		
8 Cost of oil per year at 25 cents per gal	$0.84			$0.84			$0.84			$0.98		
9 Scrubber and cooling water per hp-hour	8 gals			5 gals.			5 gals.			4 gals.		
10 Cost of water per year at 30 cents per 1000 cu. ft	$1.44			$0.90			$0.90			$0.72		
11 Operating expenses; items 4, 6, 8, and 10	$30.28	$32.28	$34.68	$26.49	$29.19	$33.24	$32.29	$37.09	$43.84	$24.85	$25.80	$26.78
12 Saving by Diesel engine	$5.43	$6.48	$7.90	$1.64	$3.39	$6.56	$7.44	$11.29	$17.06	....	....	....
13 Interest, depreciation and maintenance respectively in percent of investment	6+7+2=15%			6+7+2=15%			6+7+2=15%			6+10+3=19%		
14 Assuming $80 initial cost per hp, the yearly fixed charges will be	$12.00			$12.00			$12.00			$15.20		

The price of oil quoted for the Diesel plant is probably high, as many of these engines are operating on fuel purchased for less than 3 cents per gallon. As was pointed out, the Diesel engine's economy gains with long-hour operation, since its high initial cost and interest charges are then offset by its operating economies.

EXAMINING SOLICITORS TO ASCERTAIN THEIR GENERAL QUALIFICATIONS.

The Edison Electric Illuminating Company of Brooklyn has just held a written examination for its outside selling force in order to advise the outside salesman of some things it is necessary for him to know in the conduct of his business and also to ascertain the salesman's knowledge on the subjects covered by the questions asked. Two hours was allowed for the examination and every outside salesman was obliged to take it. Incidentally the examination also gave information on the general qualifications of the sales force of the company. Some of the requirements made of the general salesmen were as follows: "Note on the map attached the boundaries of your district." "Mark by a full black line on the map all of the direct-current lines in your district." "Mark by a dotted line on the map all of the alternating-current lines in your district." "Give name of owner and address of every private plant within your district, whether oil, gas or steam, of less than 50 hp." "Given an installation of 150 50-watt lamps burning five hours every business day, state the best form of contract and compute the monthly bill giving the rate earned."

Three of the requirements from the power salesmen were as follows: "Note on the map attached the boundaries of your district." "Give name of owner and address of each private plant within your district, whether oil, gas or steam, over 50 hp." "Given an installation of two 5-hp, three 10-hp and one 50-hp motor, with a load factor on the complete installation of 40 per cent and a maximum demand of 60 hp, figure cost of service for a twenty-five-day period on a maximum-demand power contract and the net rate earned."

Salesmen in the new installation bureau were asked for statements, of which the accompanying are typical: "Give cost per hour of burning an open-flame gas jet consuming 4 cu. ft. of gas, with gas at 80 cents per 1000 cu. ft." "Give cost per hour of burning a standard erect Welsbach mantle; also an inverted Welsbach mantle." "Give cost per month of burning two 25-watt tungsten lamps with energy at 10 cents per kw-hour, including cost of lamps, the rate of burning per night being five hours. In this answer give the average life in hours of the lamps and the proper percentage of this life to indicate the lamp cost for its use during the month."

ELECTRIC SIGN CAMPAIGN IN ST. LOUIS.

The campaign in St. Louis undertaken by the Advertising Men's League and others interested in electric signs to permit the installation of such signs over the sidewalks of that city to a point within 4 ft. of the curb is proceeding with unabated vigor. The present ordinance restricts the extension of signs to a limit of 18 in. from the building line, and was put into effect before the World's Fair of 1904, when many tawdry and inartistic signs projected over the sidewalks. It is pointed out, however, that since that time the art of installing and illuminating signs has made great progress, so that the electric signs of the present day are not to be judged by those of ten years ago.

It is declared that the electric signs of a great St. Louis brewery are to be found in New York and Washington, but not in St. Louis itself. The "Great White Way" of New York, Pennsylvania Avenue in Washington, the Campus Martius of Detroit and Grant Park in Chicago are cited as localities made more attractive and brilliant by electric signs. It is said that only two cities in the country, St. Louis and Washington, D. C., restrict projecting illuminated signs to less than half the distance between the building line and the curb. Washington, however, is not a business city, while St. Louis is. In New York signs are allowed to extend 6 ft. beyond the building line. In Chicago the limit is the curb. In Philadelphia electric signs are restricted to within 3 ft. of the curb, and in Boston to within 2.5 ft. Pittsburgh gives them one-half of the width of the sidewalk, while Detroit allows the liberal distance of 14 ft. In St. Louis, as previously stated, it is proposed to allow signs to extend to a point within 4 ft. of the curb.

The proposed ordinance in St. Louis also provides that the signs must be at least 10 ft. apart and that they shall not be installed in alleys. Further, they must be attached to the buildings in a secure manner by solid supports, and provision is made for inspection and supervision by the city. All signs shall be illuminated from sunset to 11:30 p. m. every night, and it is provided that there shall be an inspection tax of 2 cents a year for each square foot of the surface of signs, applying not only to signs projecting over sidewalks, but to all display electric signs of whatever description. It is not proposed to encourage the erection of signs in residence districts, but rather to illuminate the dark canyons of masonry in the "downtown" district. Other points made in favor of electric signs are that they increase the general illumination of streets without cost to the public, and also that they act as landmarks in making it more easy for strangers to find their way about.

BROOKLYN EDISON CHRISTMAS TREE.

The general public is beginning to appreciate the fact that a safe and sane Christmas may be enjoyed without

Christmas Tree in Edison Shop, Brooklyn.

imminent danger and constant fear of conflagration by the use of the decorative lighting outfit which eliminates the menacing candle and makes the tree much prettier and more artistic. In order to demonstrate the attractiveness and safety of these outfits the Edison Electric Illuminating Company of Brooklyn has for a number of years equipped a 30-ft. tree with all the appurtenances which go to delight the heart of the child at this season of the year and set it off with miniature incandescent lamps. The tree in the Edison Shop this year is shown herewith. It is fitted with 264 lamps of various colors and shapes representing fruits, flowers, stars, crosses, birds, clowns, etc., in addition to the plain red, white, blue and green bulbs. Last year the company loaned to the various churches of the city Christmas-tree outfits for their Yuletide festivals, with the result that this year these outfits are being purchased in large numbers for church and home use. The Edison Shop is also being kept open at night for the benefit of those who desire to purchase electrical gifts for presentation on Christmas.

CORRECTING CUSTOMERS' BILLS FOR POWER FACTOR.

In its new wholesale schedule of rates for electricity, which applies to customers having demands from 5 kw to 1000 kw, the Cleveland Electric Illuminating Company sets the following base power factors for loads of various sizes: 5 kw to 50 kw demand, 75 per cent; 50 kw to 250 kw, 80 per cent; 250 kw to 1000 kw, 85 per cent; above 1000 kw, 90 per cent.

These power factors are measured at periodical tests, and if the percentages obtained depart from the values stated the customer is accordingly penalized or credited, his demand as billed being obtained by multiplying his maximum fifteen-minute demand by the allowable power factor divided by the observed average power factor. Expressed as a formula :

$$\text{Demand as billed} = \frac{\text{observed demand} \times \text{allowable power factor}}{\text{observed power factor}}$$

This clause protects the company against undesirable loads of very low power factor, for which its investment costs in line and apparatus capacity would not be adequately recompensed by the comparatively low energy consumption obtained.

On the other hand, the customer with a high power factor gains a corresponding reduction in his bill. In many cases a profitable investment may be made in synchronous apparatus of some kind to produce a corrective condenser action on the customer's side of his service mains. Idle rotary condensers may be installed, or a synchronous motor-generator set put into service to furnish direct current to part of the load. The advantages of adjustable-speed drive with direct-current motors in machine shops offer additional reasons for installing synchronous motor-generator sets which act to improve the power factor. One large motor user in Cleveland has increased the actual power factor of his demand to as nearly unity as the company's test instruments can register, and accordingly gets a substantial reduction on his demand charges.

Under the Cleveland wholesale schedule no customer is billed at less than 5 kw demand. The rate charges are made up of a demand element plus an energy cost as follows:

Rates per month for the kilowatt demand: For the first 15 kw, $2.60 per kw; next 10 kw, $2.25; next 25 kw, $1.75; next 200 kw, $1.55; next 750 kw, $1.50; next 4000 kw, $1.25.

Rates per kw-hour used per month: For the first 600 kw-hours, 3.25 cents; next 600 kw-hours, 2.60 cents; next 600 kw-hours, 2.50 cents; next 600 kw-hours, 2.40 cents; next 600 kw-hours, 2.10 cents; next 600 kw-hours, 1.25 cents; next 100,000 kw-hours, 1 cent; next 3,500,000 kw-hours, 0.50 cent.

Wiring and Illumination

THE PABST THEATRE, MILWAUKEE.

Application of Indirect Illumination to an Old Theatre Auditorium.

It is essential to the evening's pleasure of an audience assembled at the play or concert that its sensibilities shall be assailed by no jarring note of sound, vision or personal discomfort to distract from the passive enjoyment of the production. In the revision of the illuminating scheme of the Pabst Theater, of Milwaukee, a German-American playhouse, the scene of high-class concerts, opera and stock-company productions, special emphasis was laid on the elimination of all glare-producing filaments from the field of the audience's vision, and though the auditorium is of the older pattern with high ceiling, dark walls and deep-red plush chairs and carpet, a pleasing arrangement of indirect lighting has been worked out which combines good illuminating efficiency with visional comfort.

The Pabst auditorium measures 75 ft. in length, with a clear height of 60 ft. to its old-fashioned, domed ceiling, once the setting of a huge central gas chandelier. The room now receives its principal illumination from a great suspended reflector bowl 7 ft. 6 in. in diameter containing 5000 watts of tungsten lamps, the light from which is reflected upward onto a 12-ft. white diffusing disk at the ceiling (Fig. 2). This disk was required on account of the dark ceiling of the auditorium as well as the necessity of closing the old flue shown in the cross-section sketch (Fig. 1). To prevent the lamps on the front side of the bowl from being visible from the top seats of the gallery, a sheet-metal partition has been introduced bisecting the bowl parallel to the footlights. Since the reflector bowl is nearer the balconies than the proscenium, fourteen 250-watt lamps were used on the stage side of the dividing partition, while on its balcony side there are only ten 150-watt units. These lamps are supplied through ten circuits, so that any desired degree of illumination can be obtained. The dome with its lamps can be lowered to the floor, 50 ft. below, by a windlass and cable, the push plugs of the ten circuits being slipped out of their sockets so that the fixture comes away without wires or connections.

The lower tiers of boxes are lighted from indirect reflector bowls on the balcony boxes, the low headroom requiring the design of these special fixtures with but 6-in. clearance between the bowls and the reflecting surface. Each bowl contains a single 60-watt tungsten lamp with side-type reflector, the electrical parts being cradled on insulating rests separating them from the fixture proper, which is grounded. A similar solution of close-quarter conditions was made in the case of the front row of indirect fixtures beneath the balconies which must not obstruct the view from the rear seats. Here 15 in. was available between bowl and ceiling, and to produce a graceful fixture vertical silken cords were substituted for the usual

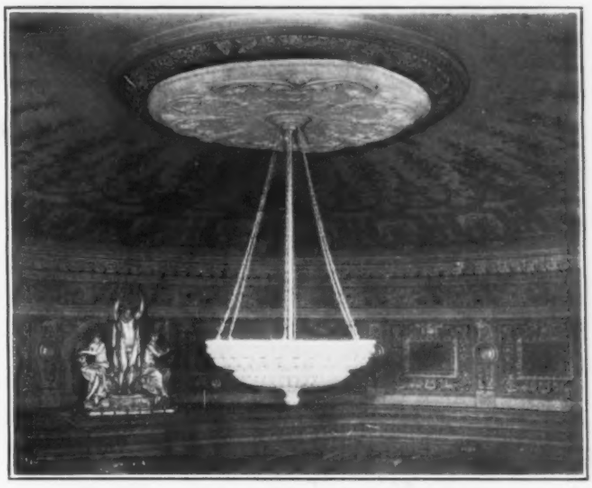


Fig. 2—Principal Fixture in Auditorium, Containing 5000 Watts in Tungsten Lamps.

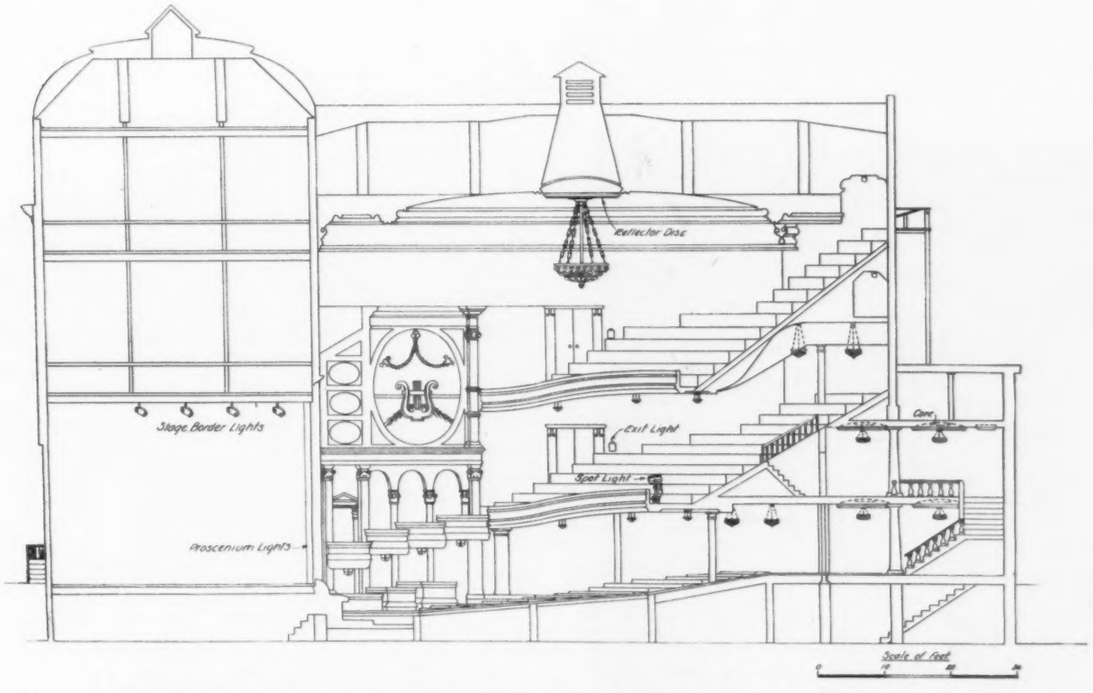


Fig. 1—Sectional Elevation of Pabst Theater, Showing Arrangement of Indirect-Lighting Units.

chains, as shown at the left in Fig. 5. Each occupies the center of a circular wreath design, the central portion of which was painted a blank white to improve reflection. Each of these silk-cord bowls contains two 60-watt lamps. The row of deeper bowls behind them, shown at the right

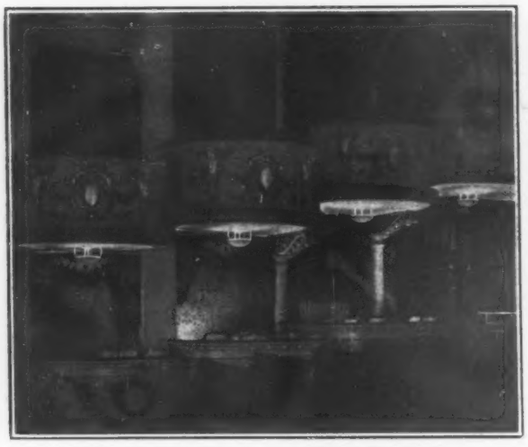


Fig. 3—Special Indirect Fixtures Over Boxes.

in the same illustration, contain four 150-watt lamps each. Their depth and position prevent any of the lamps from being seen.

Besides their use as places of entertainment, theaters have to be worked in, cleaned, repaired, etc., and for this purpose a special circuit of "working lamps" is provided at the Pabst. These are all of the direct-exposed type and are so placed as to give a good working illumination over the room with the aid of a short "working" or rehearsing border, which can be dropped from the flies of the stage. A Milwaukee ordinance requires that a number of "panic" lamps be installed in each theater, these lamps to be used for no other purpose than in emergencies. Those at the Pabst are mounted in a row over the proscenium and are controlled from two switches connected in multiple and set

Fig. 4—Illumination of Foyer from Recessed Domes.

into recesses in the walls, one at the stage electrician's post and the other at the main entrance. Wax candles in recesses in the walls are used for exit lights and are found to be economical as well as dependable. The idea of emergency service has also been extended to the balcony stairways, two-lamp electric fixtures being used where one would be sufficient, the idea being that both lamps will not be likely to burn out at the same time.

The handsome entrance and foyer of the Pabst have also received the application of indirect lighting. The recessed

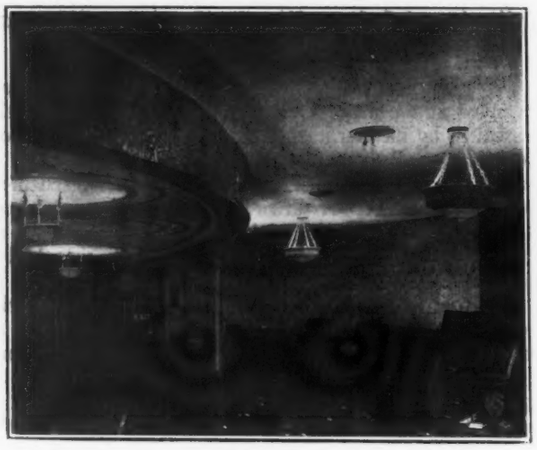


Fig. 5—Types of Indirect Units Under Balconies.

domes shown in Fig. 4 were formerly lighted by concealed lamps in the coves, but as these were insufficient a number of studded exposed units were also added. Each of the present indirect bowls in the foyer, including those over the stairway and upper level, contains four 60-watt lamps. In narow rectangular panels between the stair domes linolite units have been used. Linolite units in reflectors are also employed to light the box office window counter, a fixture being mounted on each side of the partition wall outside of the angle of vision of ticket agent and patron, thus again obtaining partly the effect of indirect illumination. Similar care has been taken in working out the lighting of the dressing-rooms, the light being projected on the face and figure of the user without visual discomfort.

Fig. 6 shows the distribution of intensities on the Pabst stage in the horizontal and vertical planes due to the footlights and border lamps. The vertical intensity is seen to fall off rapidly as the rear of the stage is approached, suggesting that this decrease in brightness may have some connection with apparent perspective and depth of stage as the actor passes from high intensity up stage into a lower intensity. Illuminometer tests with the Pabst arc spot lamp, operated from the balcony, show it to give an intensity of about 85 ft.-candles at the stage when used as a "spot light" and 2.5 ft.-candles when used as a "flood light."

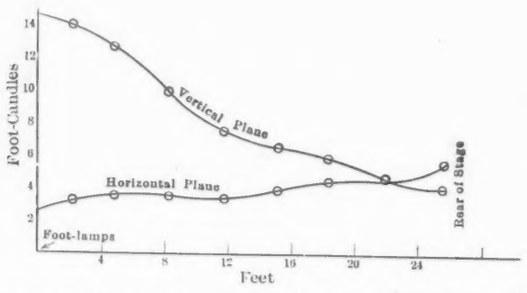


Fig. 6—Intensities in Vertical and Horizontal Planes on Stage, Due to Footlights and Borders.

The lighting fixtures in the Pabst were furnished by Mr. G. Kuehn, with the exception of the huge main inverted dome, which is a replica of the one in the Eighth Church of Christ, Scientist, Chicago (see account of indirect lighting, *Electrical World*, Oct. 7) and was furnished

by the National X-Ray Company, which also supplied the reflectors used throughout the Pabst installation. Mr. Hermann Beming was the architect for the redecoration, the illuminating engineers being Messrs. Vaughn & Meyer, also of Milwaukee.

RECENT TELEPHONE PATENTS.

ADVERTISING SYSTEM.

The well-recognized inefficiency of the average telephone line, when considered from the standpoint of actual talking time, has led to many suggestions for the introduction of some by-product use. Such suggestions have covered a considerable field, but that now brought forward by Mr. A. Pictet, of Geneva, Switzerland, is novel.

He proposes to introduce upon the lines advertising comment which will be heard by the caller while waiting for the response of the operator and again after connection is established while waiting for the response of the called party. A patent has been granted for this system.

PRIVATE EXCHANGE FEEDER SYSTEM.

Private branch exchanges of moderate size used with common-battery systems have usually been arranged to receive their energy supply from the central-office source.

To obviate the necessity for separate feeders, Mr. C. A. Simpson, of Chicago, has arranged his circuits so that the talking lines or so-called trunks serve as battery feeders when not in use for conversation. The patent is assigned to the Kellogg Switchboard & Supply Company.

METER SYSTEM.

For measured service, where a charge is made for each completed call, economy demands for each line a counting device which may be operated from the switchboard. After various vain attempts at an automatic counter which would respond only to that sequence of voltage changes incident to an originated and completed call, the counter controlled by the operator was adopted. This counter is electromagnetic, and responds to a special current introduced at the will of the operator by pressing a push-button.

While in general practice counting may be effected only during the existence of a call from the line charged, Mr. R. H. Manson, of Elyria, Ohio, has felt that there should be means to prevent more than one count on any call. To this end he introduces a relay which locks upon the first counting impulse and remains locked throughout the connection. This patent is assigned to the Dean Electric Company.

LOCK-OUT SYSTEM.

Mr. H. G. Webster, of Chicago, has obtained a patent for a lockout system which he has assigned to the Kellogg Switchboard & Supply Company. At each station a relay is so associated with the talking circuits that these are opened unless the relay be de-energized. A latch on the switch hook mechanically operates the relay armature as the hook rises, and the relay then locks in this position. Meanwhile, just at the instant of locking the latch releases its hold upon the armature. When the operator responds the potential on the line is reversed and the relay armature drops back at this moment, closing the talking circuit. This reversal and release will never occur for any station attempting to break in on a conversation.

TRUNK CIRCUIT.

Mr. C. S. Winston, of Chicago, has invented a trunk circuit for use between two two-wire switchboards. The feature of the invention lies in the arrangement of the disconnect lamp, so that the lighting of this lamp occurs after disconnection by the "A" operator, irrespective of the condition of the line to which the incoming end of the trunk is plugged. The patent is assigned to the Kellogg Switchboard & Supply Company.

LETTERS TO THE EDITOR.

Lamp and Reflector Cleaning in Machine Shops.

To the Editor of Electrical World:

SIR:—Your issue of Oct. 28 contains a short article on the subject "Cost of Lamp Cleaning in a Large Establishment." Reference is made therein to a tungsten system of lighting in an office where a large reduction in illumination was noted after a period of service without cleaning, due to dirt on lamps and reflectors. This instance emphasizes the necessity of frequent cleaning in connection with lighting systems from the point of economy, not to speak of the aid which such care renders the employees through the ease with which work can be performed on account of improved artificial lighting facilities.

In offices the accumulations of dirt are often simply a coating of light dust on the surface of lamp and reflector. In the shop, however, the dirt which gathers on lamps and reflectors is usually such as to form optical or very close contact with the glass or metal, often, moreover, being of an oily nature and reducing the light to a large extent. The importance of reflector cleaning may not appeal to the shop manager, but the losses in light due to neglect of this maintenance item are very real in their reduction of the shop economy on dark days and in the early morning and late afternoon hours throughout the winter. Actual measurements in an average shop have shown losses of light equal to 40 and 50 per cent when the systems have been allowed to go for three or four months without cleaning.

The point, however, on which the writer desires to lay special emphasis is the fact that entirely practical methods have been developed for taking care of reflector washing in large factory-lighting systems. It has been found that on an average about 3 cents will cover the entire cost of removing, washing, drying and reinstalling a soiled glass or metal reflector even under the rough conditions surrounding work of this kind in the factory. When distributed, for example, over two months this expense becomes very small indeed in terms of the hours of service and is an item fully warranted in connection with the lighting operation and maintenance.

This work may easily be developed in connection with the other items involved in the shop-lighting upkeep, and when it receives careful and systematic attention it is readily accomplished. In one factory small installations of tungsten lamps are cleaned at fairly brief intervals by the aid of small hand racks, on which the soiled reflectors are carried to a central washing station. These racks are filled with a dozen or more clean reflectors, which are taken to the location in question. The soiled reflectors are removed and the clean reflectors substituted at once, after which the soiled reflectors are returned to the lamp department for washing and temporary storage until the next installation is in need of cleaning.

The development of practical methods for systematically maintaining shop-lighting systems should be encouraged and may often be the means of producing satisfactory results from what might otherwise have been an unsatisfactory condition of affairs.

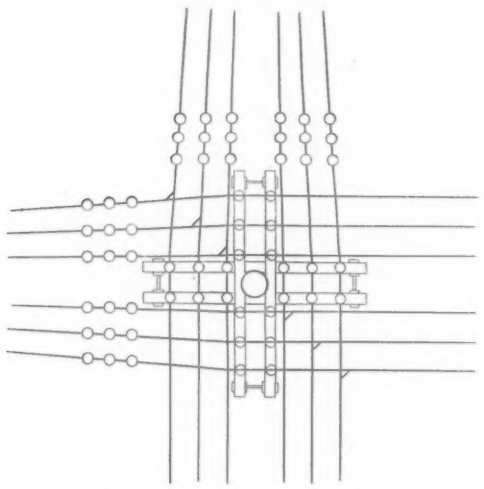
East Pittsburgh, Pa. C. E. CLEWELL.

Heavy Feeder Construction.

To the Editor Electrical World:

SIR:—In the issue of Nov. 4 an article and sketch appeared giving the method of construction used on the lines of the Cincinnati Union Gas & Electric Company for making turns in No. 2-0 feeder lines. There is no doubt that this construction will lengthen the life of pins, since it

practically eliminates them, but it is open to one criticism, namely, that the strain is all thrown upon the cross-arm, and even though the ends of the arms be guyed back to



Method of Making Turns in Feeder Construction.

take the strain the time comes when the arms must be renewed, and for this purpose the entire construction must be torn down.

The accompanying sketch shows the construction that I have used very successfully for making turns in No. 4-0 feeder lines. Top-grooved porcelain insulators are used, and each wire is guyed separately, being insulated from the guy wire by three guy-strain porcelain insulators. As the wires on the upper cross-arm pass over all the wires on the lower arm before reaching the strain insulators, vertical jumpers are used. For this purpose stranded cable of the same area as the solid feeder has been found to work more readily, save time and make a good appearance. The cost of strain insulators to make a turn in six No. 4-0 wires will be less than $2.50. No. 4-0 solid wire being rather difficult to make up around the guy strain insulator, the end of the wire is simply looped around it and held by a wire-rope clip or U-bolt.

The lines do not have to be torn down in order to renew a cross-arm; and since the arms are under no strain except the weight of the lines, they do not have to be renewed so often, and a standard arm can be used. Moreover, the pins do not break off, as they are under no lateral strain.

While the operation is quite dangerous and not to be recommended, it is possible to renew the cross-arms in this construction without interrupting the service. An arm equipped with pins but no insulators is placed under the wires, the pins holding the wires apart. The tie wires are then removed and the temporary arm is raised, carrying the wires with it, just high enough to allow the old arm to be removed and the new one put in place.

Raleigh, N. C. C. E. D. Egerton.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Compensated Three-Phase Commutator Machines.—F. Niethammer and E. Siegel.—A mathematical article illustrated by diagrams giving the theory of the compensated three-phase commutator machine, the characteristic curve of which is that of a shunt machine ("Scherbius shunt machine"). In a second paper the authors show that this motor type can give a "series" characteristic if the rotor current be passed through the excitations winding so that the flux depends on the load at any moment. The theory of this type ("Scherbius series machine") is given with the aid of diagrams.—*Elek. u. Masch.* (Vienna), Oct. 22, Nov. 5 and 12.

Frequency Changers.—P. Bunet.—A concise review of the different types of frequency changers.—*La Lumière Elec.*, Nov. 25.

Lamps and Lighting.

Universal Portable Photometer.—Clayton H. Sharp and Preston S. Millar.—The authors refer to their standard universal photometer described in the *Electrical World*, Jan. 25, 1908. They have now designed a much smaller instrument which is intended especially for field work on account of its greater portability. In some respects it is slightly less accurate than the standard instrument. The length is 14.5 in. (37 cm) and the cross-section 2.5 in. by 2.5 in. (6.3 cm by 6.3 cm). The plan of the small model is illustrated in Fig. 1, showing the essential features. *P* is the reversible tube, bearing test plate and diaphragm; *T* is the elbow tube; *G* and *G* are absorbing screens; *S* is the photometric device, *D* the diffusing glass, *I* the interrupter for the telephone circuit, *L* the comparison lamp carriage, *R* an adjustable rheostat, *W* a screw-driven cursor on slide wire in bridge, *K* the knob for the comparison lamp drive. The troublesome feature in all small portable photometers is the comparison lamp. In the new design the large resistance-temperature coefficient of the tungsten filament is taken advantage of. The lamp is connected so as to constitute one arm of a Wheatstone bridge. The other arms are composed of small coils of manganin wire. Between one lamp terminal and one coil a portion of this wire is extended to form a slide wire, and a scale is arranged to indicate the position of the cursor on this wire. The coils have such a resistance that when the lamp is receiving its proper current its resistance will be such that the balance point of the bridge will come within the range of the cursor on the slide wire. Any change in the current through the lamp is accompanied by a corresponding change in its resistance and the bridge is thrown out of balance. As a convenient means of detecting the point of balance of the bridge, a low-resistance telephone receiver is used. In series with the receiver is an interrupter consisting of a wheel into the periphery of which pieces of insulating material have been set at frequent intervals. The two bridge arms which are in parallel with the lamp and its corresponding arm have approximately five times the resistance of the latter, so that the amount of additional current which they require

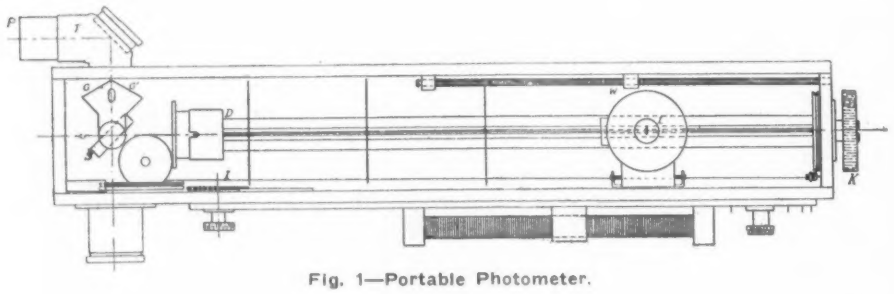


Fig. 1—Portable Photometer.

produces no undue drain on the battery. The telephone receiver is provided with a head band so that both hands are left free for the operation of rotating the contact wheel and adjusting the external rheostat until a condition of silence in the telephone is attained. The adjustment of current in this way can be made to within about 1 milliampere (one-third of 1 per cent), which is substantially the limit of accuracy of a high-grade ammeter. Therefore the measurement involves in the shape of apparatus external to the photometer only the telephone receiver, which can be readily carried in the pocket if desired. The optical system has been somewhat changed. In place of the modified Lummer-Brodhun prism as a photometer screen, a circular mirror of thin glass, silvered on the back, with a small round hole cut in the silvering, is employed. The mirror is placed at an angle of 45 deg. to the axis of the box and is viewed through the eyepiece in the ordinary way. A single small storage cell or two dry cells give the current for the lamp. The calibration and the use of the instrument are described.—*Illuminating Engineer,* December.

Arc-Lamp Electrodes.—A note on a recent British patent (No. 17,723, Nov. 23, 1911) of the British Thomson-Houston Company (General Electric Company of this country). In the practice of mixing a steadying material with the lighting material for steadying the arc it is found that the arc takes up the former before vaporizing the latter, with the result that the proportion between the amounts of these vapors in the arc does not remain constant, thus producing a wide variation in either the intensity or the color of the light, or both, from the materials. According to the present invention, which is particularly applicable to alternating-current working, the light-giving material is introduced into the arc from one electrode during the first half period of the current, while the steadying material is introduced during the second half period from the other electrode, thereby fattening and giving conductivity to the arc. In one form titanium carbide is inclosed in a thin iron shell, while the other electrode is made of carbon impregnated with potassium biborate and then dried.—Lond. *Elec. Eng'ing,* Nov. 30.

Train Lighting.—R. T. SMITH.—A paper read before the (British) Institute of Civil Engineers on "the electric lighting of railway trains and the brake-vehicle method." The method of train lighting considered in this paper is that in use on the Great Western Railway, where axle-driven generators and storage batteries, controlled by an automatic regulator, are installed in some of the passenger cars. The lamps throughout the train receive energy from these equipments, which work in parallel, as is usual with systems of electric supply at constant voltage. In general, apparatus and batteries are installed on brake vehicles only, several other cars receiving energy from them under complete automatic control as to voltage. There is a consequent appreciable reduction in the initial cost and in the cost of upkeep of plant, with what is of chief importance from the railway point of view, greater reliability.—Lond. *Electrician,* Dec. 1.

Generation, Transmission and Distribution.

Manchester.—An abstract of last year's financial account of the municipal electric station of Manchester, England. The sales of energy increased by 12,000,000 kw-hours over the preceding year. The total number of kw-hours generated during the twelve months was 115,400,446, of which 83,308,848 were sold and 8,843,846 used on the works. The quantity lost in distribution was, therefore, 23,247,734 kw-hours, or 20.15 per cent of the total generated. The corresponding figures for the two preceding years were 18.10 per cent and 16.96 per cent respectively. The steady increase during the last year or two is probably accounted for by the greater proportion of the output now being transmitted as high-tension energy from the Stuart Street station. The total output comprises 54,718,320 kw-hours sold to private consumers for lighting, heating and motor service, 167,001 for public lighting and 28,423,527 for the tramways. The maximum load recorded during the year was 28,210 kw for lighting and stationary motor service, and 9310 kw for the traction supply, a total of 37,520 kw. The load factor was 25.35 per cent, as against 24.18 per cent in the previous year. The total rating of the generating plant installed was 47,300 kw. The total costs, excluding capital charges, have decreased from 1.22 cents to 1.08 cents per kw-hour sold, this decrease being spread over several items. The cost of fuel is 0.40 cent per kw-hour sold. The new storage battery installed contributes considerably to the reduction in the cost of production. The total cost, including capital charges per kw-hour sold, was 2.04 cents, against 2.28 cents in the preceding year. The total revenue per kw-hour sold was 2.32 cents; hence there was a surplus balance of 0.28 cent per kw-hour. Separate figures are given for the generating cost in the three stations in the city. These figures are of interest as indicating the economies possible in a large station. Thus salaries and wages at the Stuart Street station total only 12 per cent more than at the other stations, although the output is nearly three times as great.—Lond. *Electrician,* Nov. 24.

Swiss Water-Power Plant.—FREYER.—A profusely illustrated description of the Loentsch water-power plant in Switzerland, which is equipped with six Pelton wheels coupled to 5250-kva, 8000-volt, 50-cycle, three-phase generators. The transmission emfs are 8000, 27,000 and 48,000 volts. The plant is working in parallel with the Beznan power plant, at a distance of 85 km (51 miles). The Beznan plant is uniformly loaded, while the Loentsch plant supplies the energy for peak loads.—*Elek. Kraftbetr. u. Bahnen,* Nov. 4.

Electric Supply for Christiania.—A note stating that a special committee appointed to consider the question of supplying Christiania in Norway with electric energy has recently issued its report, and recommends the exploitation of the waterfalls belonging to the city, and the acceptance of an offer from the Vamma Power Company to supply 25,000 hp at a price agreed upon. The transmission installations proposed are to have a rated equipment of 56,000 hp, and at the expiration of the contract time they will pass into the possession of the town, in the year 1948, for a sum of $1,200,000, which sum the town will hand over to the company free of interest until 1919 and after that time subject to an interest of 4.5 per cent. It is estimated that the town's waterfalls in the River Glommen will yield 28,000 hp.—Lond. *Electrician,* Dec. 1.

Eddy-Current Brake.—J. M. G. SCHAEFFER.—An account of an experimental investigation of an eddy-current brake of the Tasqualini system. The analogy between the induction phenomena in the brake disk and in the short-circuit armature of an induction motor is shown. The author concludes that copper is unsuitable for a brake disk and that bronze is more suitable. He further discusses the occurrence of a certain undesirable axial pressure and means of avoiding it.—*Elek. u. Masch.* (Vienna), Nov. 12.

Refuse Destruction.—E. DE FODOR.—A review of the present status of refuse destruction in connection with the generation of electrical energy. This method has made progress especially in England. The author thinks that most of the cities of Continental Europe can count on the average on 1 kg of steam per kilogram of refuse burned.—*La Lumière Elec.,* Nov. 18.

Traction.

Mine Locomotives.—G. BRIGHT.—An article on the determination of the weight and equipment of mine locomotives.—*Elec. Journal,* November.

Installations, Systems and Appliances.

Automatic Reversible Battery Boosters.—R. RANKIN.—

The first part of an illustrated paper read before the (British) Institution of Electrical Engineers. A short account is first given of the uses and advantages of a battery-booster plant and the savings likely to be effected by its employment. Boosters are classified under three main divisions. Under class A are described the plain differential Pirani, Crompton and Lancashire systems. Under class B are the Highfield and E. C. C. systems. The advantages of boosters controlled by external regulators over those of the diverter type are briefly mentioned. Such boosters belong to class C, which includes the Entz, B. T.-H., Taylor, Scotson, Tilney, Thury and Brown-Boveri boosters, while the systems of Lincoln and Bijur are also referred to. Some methods of using a battery-booster plant are then considered more fully, and several methods of adapting such a plant to the control of winding gear are described. The employment of batteries on alternating-current systems is next treated, while finally some figures are given relating to the plant at the Gary Steel Works, and a short description follows of the Hucknall colliery plant.—Lond. *Electrician*, Nov. 24.

Cooking by Gas and Electricity.—F. Meurer.—A very long paper presented before a society of gas engineers. The author criticises the conclusions of Ritter and Dettmar, which had been in favor of electricity, and describes a series of experiments from which he draws the following conclusions. The latest electric cooking apparatus and the latest gas cookers were used. The comparison shows that the heat requirements with electric cooking are about 65 per cent of those for gas cooking. Hence the costs of electric and gas cooking will be the same if gas costs 2.5 cents per cu. m (or 71 cents per 1000 cu. ft.) and electricity 0.74 cent per kw-hour; if gas costs 3 cents per cu. m (or 85 cents per 1000 cu. ft.) and electricity 0.88 cent per kw-hour; if gas costs 3.5 cents per cu. m (or 99 cents per 1000 cu. ft.) and electricity 1.03 cent per kw-hour; or if gas costs 4 cents per cu. m (or $1.13 per 1000 cu. ft.) and electricity 1.18 cents per kw-hour. Hence, he concludes that in most cases the electrical energy would have to be sold at a rate below cost of generation in order to make electric cooking as cheap as gas cooking.—*Journal f. Gasbeleucht*, Nov. 25.

Electric Heating.—C. A. Rossander.—A review of the present status of electric heating with special reference to the design of electric-heating apparatus and the different types of electric resistors used in them. The author also discusses at some length the tariff question and thinks that the central stations should not be expected to make all the concessions, but that the subscribers themselves should arrange the use of the heating apparatus in such a way that they would not use these appliances during the hours of the day that bring the peak load on the central station.—*La Lumière Elec.*, Nov. 25.

Electric Installation of a Country House.—F. H. Davies.—An illustrated description of the electric installation in a country house some miles out of London. The special feature is that energy for lighting, heating and cooking is derived from an automobile engine without in any way interfering with the regular use of the car. The generator is a 5.5-kw machine driven by the automobile engine at 1650 r.p.m. by means of a 13-in. special split pulley fixed to the shaft on the engine side of the clutch. The length of the drive is 6 ft. A battery of 200 amp-hours rating is used. As there is ample margin in the generating and battery plant, it is proposed to extend the use of the equipment to water pumping and lawn mowing. A double-voltage supply is provided, 50 volts being used for lighting and the cooking apparatus being operated at 70 volts off the whole battery. Three bare overhead wires, about 35 ft. long, transmit energy to the house, where the supply is tapped off at 50 volts or 70 volts, as may be required. The total cost of installation has been $500.—Lond. *Elec. Review*, Dec. 1.

Wires, Wiring and Conduits.

Phasophone Control of Insulation Resistance of Three-Phase Networks.—H. Osten.—To prevent the break-down of a network the continuous control of the insulation conditions are of great importance. The author describes an instrument, called the phasophone, devised to detect the development of an insulation failure in its incipiency. By localizing the fault it is then possible to repair the fault before the break-down actually occurs. The connections of the phasophone are shown in Fig. 2. *C* and *C* are two condensers. Between 1 and 2 is inserted a telephone *T*

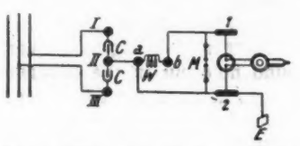


Fig. 2—Diagram of Connections.

in parallel with a micrometer spark-gap for protection. Between *a* and terminal 1 there is a non-inductive resistor *w* of about 1 megohm resistance, while terminal 2 is connected to earth *E*. To investigate the condition of the line, one has to listen in the telephone for at least ten minutes. The sound heard is uniform and quiet as long as the network is in good condition. Faults, sparks, poor operation in parallel of machines, poor contacts, etc., are recognized by a change in the telephone sound.—*Elek. Kraftbetr. u. Bahnen*, Oct. 24.

Cables Connected with Overhead Lines.—J. Grosselin.—The author investigates how far the manufacturers of cables can satisfy the regulations in force in the different countries. The question of the safety coefficient is a debatable one. It seems that the safety coefficient required in France is too high, since in Germany and Italy the regulations are less rigorous. The author thinks that it would be good to adhere to the formula given by Marchena at the Marseilles congress of 1908 for alternating-current cables of 25,000 volts to 50,000 volts, while beyond that the coefficient 1.5 should be adopted. For direct-current cables the coefficient 1.25 would be sufficient. The author discusses especially the question of dangerous rises of voltage in cables connected with overhead lines and sums up briefly some of the protection devices used in such cases.—*La Lumière Elec.*, Nov. 18.

Neutral Point of Alternating-Current Networks.—F. Leprince-Ringuet.—The author discusses mathematically the problem how to illustrate graphically the changes of the neutral point of an alternating-current network due to the variation of one of the elements of the network, especially when the insulation resistance of one of the poles with respect to earth is varied. He shows that the graphical solution is given in all cases by circular diagrams. The result of experiments is in agreement with the theory.—*La Lumière Elec.*—Nov. 25.

Electrophysics and Magnetism.

Vacuum Oscillation Valves.—R. S. Willows and S. E. Hill.—The rectifying action of vacuum oscillation valves depends upon the fact that the glowing filament emits negative ions readily. If this emission can be increased, the sensitiveness of the valve should also rise. This can be effected by having a layer of, say, incandescent lime on the filament. The effect is increased by having a substance such as aluminum phosphate giving positive ions on the second electrode. The authors investigate the effect of a polarizing emf on this arrangement. Such an emf is beneficial or disadvantageous according to its value. The effect is discussed and explained.—Lond. *Electrician*, Dec. 1.

Direct Current and Alternating Current in the Same Circuit.—W. Vieweger.—A simple experimental proof for

demonstration purposes that a direct current and an alternating current can be at the same time in the same circuit. The method depends on the use of three instruments, of which a Weston direct-current voltmeter measures only direct current; a Ferraris voltmeter, operating on the rotary-field principle, measures only the alternating current, and a hot-wire instrument measures both.—*Elek. u. Masch.* (Vienna), Oct. 22.

Inductance of Linear Conductors.—A. C. JOLLEY AND A. F. BURGESS.—A continuation of their illustrated paper on the experimental determination of the inductance of linear conductors.—Lond. *Electrician,* Dec. 1.

Electrochemistry and Batteries.

Storage Batteries.—H. BECKMANN.—A review of the present status of stationary and portable storage batteries. —*La Lumière Elec.,* Nov. 11.

Alkali Accumulator.—J. A. MONTPELLIER.—A comparison of the Edison storage battery and the Gouin battery, both of which use an alkaline solution and iron and nickel electrodes. The author's conclusions favor the Gouin battery.—*La Lumière Elec.,* Nov. 25.

Units, Measurements and Instruments.

Measuring the Slip of Induction Motors.—E. SCHNECKENBERG.—If a disk rotates synchronously with the rotor of an induction motor and a stationary pencil is pressed against the disk in such a way as to plot a spiral line on it, it is possible to count the number of complete revolutions c which the disk has made in a certain time. If now in some way a special mark is made in this spiral line once during every period of the alternating current and if there are b such marks while the disk has made c revolutions, then the slip in per cent is $(1 - cp/b) \times 100$, where $2p$ is the number of poles of the motor. Andrault uses as disk a circular copper sheet covered with chemically prepared paper (for instance, impregnated with potassium iodide and starch). As pencil he uses an iron rod, which is connected with one terminal of the motor, while the other terminal is connected with the copper disk, an incandescent lamp being placed in series as a resistor. By electrolytic action the potassium iodide is decomposed and the iodine acts on the starch, giving a blue color. In this way a blue line is obtained on the paper. But in the moments when the current wave passes through zero there is no decomposition and the paper is not colored blue in these moments. Hence twice in every complete cycle of the alternating current there is a white mark. If there are b such white marks for c revolutions of the spiral the slip is $(1 - 2\,cp/b) \times 100$ per cent. Slip-meters of this kind can be made as simple and convenient in construction as speed-meters, and, like the latter, they are simply pressed against the end of the motor axle. By using simultaneously a slip-meter and a revolution meter the frequency can be found. It is $bn \div (120\,c)$ periods per second, if n is the number of revolutions per minute. The author describes a very simple construction of such a slip-meter.—*Elek. Zeit.,* Nov. 16.

Alternating-Current Motor Meter.—W. ROGOWSKI.—An article illustrated by diagrams on the phenomena in the braking disk of an alternating-current motor meter. By means of Maxwell's fundamental equations the author discusses the current distribution in the motor disk when at rest and calculates the torque, the Joulean loss and the reaction of the motor disk.—*Elek. u. Masch.* (Vienna), Nov. 5.

Two-Wattmeter Method.—D. H. OGLEY.—An article on the two-wattmeter method of measuring power in three-phase circuits. With the aid of formulas and diagrams the author shows why the readings of the two meters may vary considerably although they are connected in a precisely similar matter to the supply.—Lond. *Elec. Review,* Dec. 1.

Compass.—A fully illustrated description of the Anschütz gyro compass exhibited by a British firm at the recent electrical exhibition in London.—Lond. *Elec. Review,* Dec. 1.

Telegraphy, Telephony and Signals.

Connections of Telephonic Transmission.—L. SABATIER. —In a former article the author has compared the shunt connection of the microphone with the series connection. In the present article the author discusses the general conditions under which the Wheatstone-bridge arrangement can be used in telephone transmission. He determines mathematically the effect of this method of connection on the efficiency of transmission and the best values to be given to the resistances in order to get as high an economy as possible. The results of his analysis are given in a series of diagrams.—*La Lumière Elec.,* Nov. 11.

Wireless Telegraphy.—A fully illustrated description of the wireless telegraph station in Nauen, Germany, using the Telefunken system.—Lond. *Electrician,* Dec. 1.

Distant Vision.—A. A. CAMPBELL.—His illustrated presidential address to the (British) Röntgen Society on distant electric vision. The proposed system is based on the illumination produced on a phosphorescence screen in a vacuum tube by the impact of a pencil of cathode rays deflected by a magnetic field.—Lond. *Electrician,* Dec. 1.

Miscellaneous.

Association of Consulting Engineers.—An editorial on the proposed formation of an association of consulting engineers in Great Britain. One of the chief points of the policy is "the restriction of membership to those qualified by experience and freedom from trade ties to act as consultants in unbiased fashion."—Lond. *Electrician,* Dec. 1.

BOOK REVIEWS.

CYCLOPEDIA OF TELEPHONY AND TELEGRAPHY. Four Volumes. Chicago: American School of Correspondence. Price, $12.80.

The first volume of this set of elementary textbooks on telegraphy and telephony as employed on the North American continent treats of telephony under the heads of fundamental principles, substation equipment, party-line systems, protection and manual switchboards. Volume II also deals with wire telephony topics, namely, manual switchboards, automatic systems, power plants and buildings, special-service features, telegraph and railway work (telephonic). The third volume discusses the following telephonic subjects: Line construction, engineering and maintenance, electrical measurements and storage batteries. The fourth volume takes up the electric telegraph, wireless telegraphy and telephony, the elements of electricity, the electric current, the telautograph and the telegraphone.

The text of these books is clear and well edited. The illustrations are excellent and abundant. The books are particularly strong on the practical, constructive and descriptive sides. Switchboard mechanisms, both manual and automatic, are particularly well treated. On the other hand, the chapters on electrical measurements are several grades ahead of the rest of the work, in regard to the preparation required for their proper study. The books will be especially useful to students of telephonic and telegraphic materials, apparatus and systems as used in the United States.

ELECTRIC CRANE CONSTRUCTION. By Claude W. Hill. Philadelphia: J. B. Lippincott Company. 308 pages, 366 illus. and 23 tables. Price, $8.

A good textbook on electric cranes, incidentally containing much valuable engineering information on the mechanical features of cranes in British construction and service. An excellent feature of the work is the large number of

plates and drawings showing the dimensions and details of actual working cranes. The book would be valuable merely as a compendium of dimension drawings of these constructions. The chapters relate successively to the following subjects: Overhead cranes, portable jib cranes, derrick cranes, transporters, sheer legs, revolving cantilever cranes, cableways, power required for crane-driving, starting torque and acceleration, design of crane structures, design of machinery, brakes, toothed gearing, hooks, ropes and chains, design of magnets, motors, controllers and collectors, crane installations. The book will be of value to both mechanical and electrical engineers, as well as to factory engineers, besides being a textbook on crane construction.

Statistik der Electricitätswerke in Österreich. Vienna: Electrotechnischen Verein. 108 pages. Price, 3.80 kronen.

This work contains very complete statistics of all central stations operating in Austria and also those under construction. It also gives a summary showing their development in recent years. The data are arranged in a practical way and in such a manner that any information desired can be found easily.

Statistics are given for only those stations that sell electric energy for public purposes or to private consumers. Isolated plants and traction plants are not included. There were 740 stations with an aggregate rating of 378,736 kw (against 675 stations with 318,614 kw in the preceding year). Two hundred and eighty-seven stations were municipal; 453 were owned by private persons or corporations. Of these stations 332 were operated by water-power, 129 by steam-power, 77 by gas, 92 by water and steam, 54 by water and gas, 19 by steam and gas, 11 by steam, water and gas, and 26 bought electricity in bulk; 425 stations used overhead wires, 21 cables, 216 cables and overhead lines, while no information about this point was available from 78 stations.

New Apparatus and Appliances

ELECTRIC STEERING GEAR FOR SHIPS.

Among all the varied applications of electricity on board ship one of the belated substitutions of motors for steam power is in the steering gear itself. The clumsy and inefficient steam-rudder mechanism has heretofore been standard in marine construction, but several battleships of the United States Navy are now equipped with electric steering gear and similar apparatus is being installed on some new merchant vessels.

The application of electricity to the steering problem has made possible a number of simplifications and niceties of control which the practical mariner has not been equally quick to appreciate. For example, the pilot accustomed to his huge wheel looks doubtfully on the little electric tiller handle to which the 20,000-ton battleship responds like a rowboat.

Two types of electric steering gear are employed. In the first and simpler a reversing switch operates the rudder motor either to port or starboard until the desired angle is reached as reported by an independent indicator in front of the helmsman. With the other system, known as the "follow-up" gear, the steering wheel is moved over to the desired angle and the rudder follows until this position is reached as in the familiar steam gear. This latter "follow-up" system, of course, involves greater complexity of wiring and mechanical connections, and it seems likely that the first method will gain favor as mariners become more accustomed to electrical steering.

The accompanying illustration shows the tiller switch used by the Cutler-Hammer Manufacturing Company, Milwaukee, in connection with its electric steering gear for naval and merchant vessels. The controller contacts handle only small auxiliary currents which actuate the magnet contactors of the rudder motor. Throwing the handle to port causes the rudder to move in that direction as long as the switch is depressed, the advancing position of the rudder being reported back to the pilot by an indicator as already mentioned. Two speeds are provided in each direction, one for ordinary steering and the other for quick rudder movements.

The speed requirements made by the United States Navy stipulate a rudder swing from hard aport to starboard in twenty seconds. The rudder has a maximum swing of 35 deg. in each direction, at the end of which travel limit switches shut off the motor if the helm handle is still held off center. The controller is also provided with a deadman's handle and returns to its neutral position when released. Several such controller helms as that shown can be placed in an equal number of locations about the vessel, since only a few small control wires are required to connect them with the steering gear. Besides this possibility of steering from any one of several positions, the electric gear operates much more rapidly than the steam apparatus. It also occupies less space and is more efficient. A 300-hp motor-driven gear installed on one battleship replaced the 900-hp steam gear formerly in use. The size of motor required depends, of course, on the size and speed of the ship, ranging from 300 hp for the large vessels down to 50 hp for the slower merchant steamers.

Fig. 1—Electric Steering Controller on Bridge of "Texas."

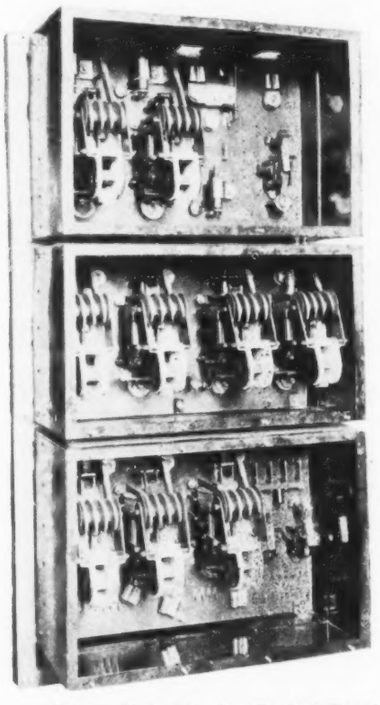
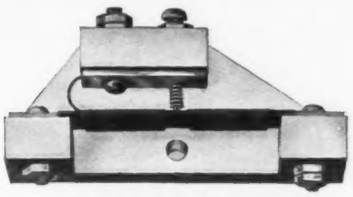


Fig. 2—Main Steering Control Panel and Contactors in Steering-Engine Room on "Texas."

NEW ONE-LAMP FLASHER.

A simple "motorless" lamp flasher recently produced by the Phelps Manufacturing Company, 265 Jefferson Avenue, Detroit, Mich., is illustrated herewith. This small flasher, which is only 2⅝ in. in greatest dimension and weighs but 1½ oz., is of the thermostat type. It is a one-lamp flasher



New One-Lamp Flasher.

having a rating of ½ amp. The expansion bar of the thermostat is of aluminum, provided with shunt winding and platinum contacts. A lock nut is provided for holding the adjustment permanently, and both ends of the monometallic thermostat are securely bolted so as to prevent vibration. The non-metallic parts are of porcelain. This flasher is intended for small window signs, novelties, Christmas-tree lighting and the like.

INSULATED SCREWDRIVER.

The friction-drive screwdriver made by the Benjamin-Sellar Manufacturing Company, 559 West Quincy Street, Chicago, is now available in insulated form for electricians. The entire blade, with the exception of the point, is covered with hard-rubber tubing molded securely into the handle. It is asserted that the insulation has been tested to 11,000 volts, but the manufacturer takes pains to say that linemen working on high-potential circuits should not depend entirely upon the insulation of any tool unless they are well insulated from ground. The insulated portion of the blade is ⅜ in. in diameter throughout its length, and blades may be 3 in. or 6 in. long. The tool is of the patented friction-drive type of screwdriver, provided with friction cap which moves with the hand, engaging the handle, but returning in reverse movement with the motion of the hand, without backing the screw.

AUTOMATICALLY CONTROLLED ELECTRIC RANGE WITH HEAT STORAGE.

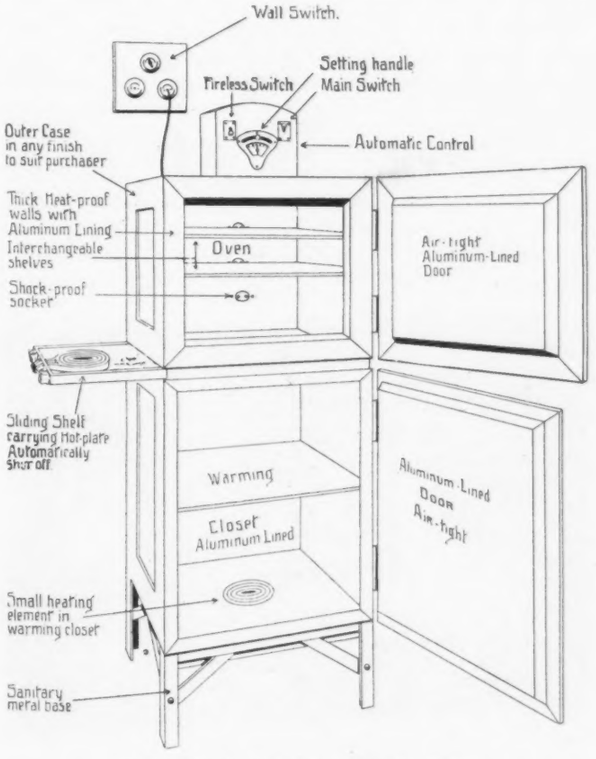
An electric range which possesses many novel features and which should appeal to the housewife because of the convenience of its arrangement and the automatic control of the heat, not to mention its conservation, is shown herewith. The illustration tells its own story. The cupboard-like arrangement has an oven, at a workable height from the floor, which is heavily lagged so as to store the heat. The inside of the oven is fitted with shelves, upon which the articles to be cooked are placed and in which the heating elements are embedded. The shelves are interchangeable and reversible, and are placed in circuit by merely pushing them in the oven as far as they will go. By slightly withdrawing any of them so that it does not touch the socket in the back of the oven it becomes an ordinary shelf. By this means the oven may be heated at special points or the heat may be distributed evenly over the whole oven.

The interior is lined with aluminum, which, retaining its luster, reflects the heat back to the food. The oven door fits air-tight and, being lagged, prevents any escape of heat through the door. Underneath the oven at the side and, although not shown in the engraving, also at the front are sliding shelves, each of which contains a circular hot-plate. Until these shelves are pulled out from beneath the oven they are not in circuit; but when they are pulled out as far as they will go they automatically connect themselves in circuit and may be used for frying and broiling. If it is desired to employ them as ordinary shelves without heat, a switch is provided for cutting them out of circuit when in their outward position.

The heat in the oven is controlled by means of a thermostatic switch located above it, as shown, and the switch is adjustable for various temperatures. Thus when baking bread, for instance, the chart at the side of the oven indicates that a temperature of 300 deg. is required. The switch is set at that figure, and when the heat in the oven reaches the desired temperature the circuit is automatically opened.

When the food has absorbed enough heat to lower the temperature 3 deg. the circuit is again automatically made, and throughout the operation there is this automatic cutting off and switching out of the energy, so that uniform heat is obtained. Should it be desirable to shut off the energy permanently after a certain temperature is reached the dial may be set to bring this about, and, the heat being conserved, the oven is in this way converted into a fireless cooker.

Beneath the oven is a commodious warming closet. The compartment is lagged on all sides so as to retain the heat, and in addition there is a small heating element at the



Automatically Controlled Electric Range.

bottom which may be placed in circuit when desired, only a small amount of energy being required to warm the compartment. The range may be finished to match the decorations in the kitchen, although ordinarily the aluminum and nickel finish of the standard article are not incongruous. The outfit is manufactured by the Automatic Electric Cook Company, Ltd., Temple Building, Toronto, Ontario, Canada.

AUTOMATIC AUTOMOBILE LIGHTING SYSTEM.

An improved automatic electric-lighting system for automobile use has recently been developed by the Ward Leonard Electric Company, Bronxville, N. Y. In addition

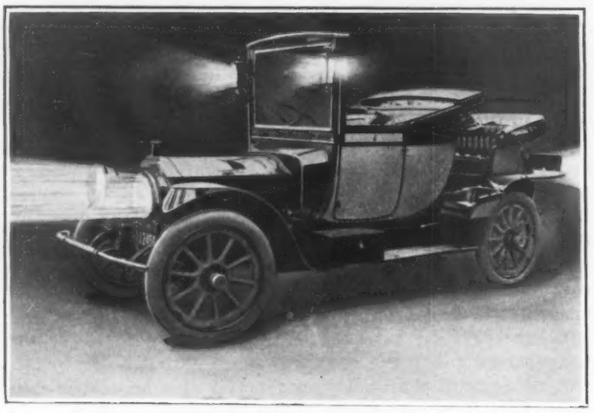


Fig. 1—Automobile Completely Equipped with Electric Lamps.

to a number of other special advantages, this new system avoids the use of centrifugal governors, friction drive, automatic rheostats, additional brushes or armature windings, differential field windings, belt drive or permanent magnets. The generator is of the wound-field type, insuring superior power and efficiency. A silent chain, or other equivalent positive driving means, operates the generator from the engine shaft.

As the speed of the engine, and consequently that of the generator, rises, the generator emf becoming greater than the storage-battery emf causes an electrically operated voltage switch to close automatically, connecting the batteries to the generator. Should the generator voltage fall below that of the cell, the same switch automatically opens, preventing back-discharge of the battery.

At increased car speeds, when the generator voltage becomes so high that the charging current flowing into the battery exceeds a predetermined amount, an automatic series switch opens to insert a single step of resistance into

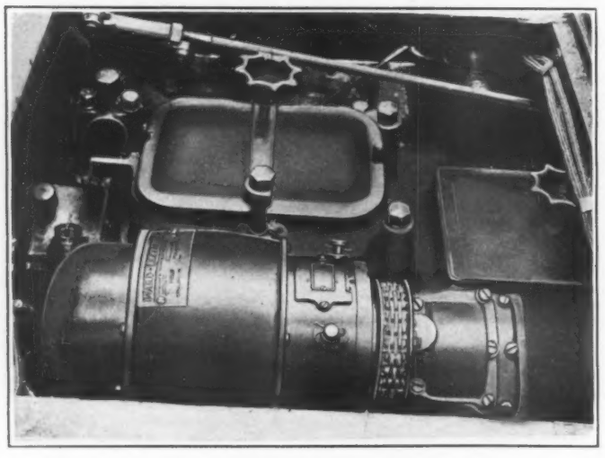


Fig. 2—Generator Chain-Driven from Engine.

the dynamo field. The result is to reduce the generator current output to a point where the switch again closes, short-circuiting the generator field resistance. This action continues intermittently in a way generally similar to that of the automatic field regulation of alternators. Thus, regardless of any high speed that the engine may attain, the charging current delivered by the generator remains between predetermined limits proper for charging. The generator is arranged to charge the battery at car speeds above 10 miles an hour.

A feature of the system is the provision of duplicate batteries, each smaller than the ordinary battery and either one of which can be thrown into circuit by a double-throw switch. While one battery is being used for ignition, the other is employed for lighting, thus insuring that the grounded ignition system and the ungrounded lighting system be kept entirely separate. The importance of this provision is realized, as a grounded circuit might "kill" the ignition system and "stall" the car, to the serious inconvenience of its occupants.

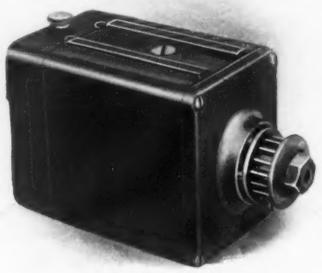
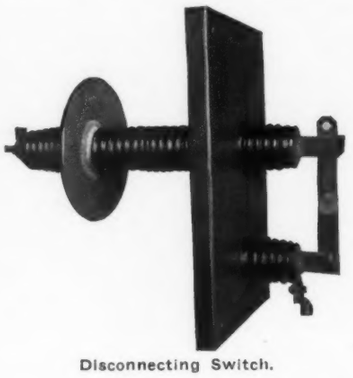


Fig. 3—Automobile Lighting Generator.

DISCONNECTING SWITCH.

The demand for an increased factor of safety in high-tension transmission systems has developed the need of station entrances which not only permit ready access to the equipment, but also incorporate a disconnecting feature, thus enabling an operator to isolate quickly a given feeder or set of busbars.

One of recent development for this service is the type of entrance tube and disconnecting switch illustrated herewith and manufactured by the Delta-Star Electric Company, Chicago. The disconnecting switch is of the combination front-and-back-connected type, the long insulator being carried back through the supporting base and in turn having mounted upon it a disk insulator. This insulator is provided with a copper core, to one end of which is attached a locking type switchblade, the other end being provided with a suitable lug, to which the incoming line wire is soldered To mount the device in position, it is simply necessary to leave a circular hole in the station wall and secure the mounting base in position by means of four expansion bolts or studs. With this combination a permanent entrance is secured and one which is proof against entrance of moisture, dust or insects.



Disconnecting Switch.

LIGHTING OF A MODERN STORE BUILDING.

In planning details for the new store of Bonwit, Teller & Company, located at the corner of Fifth Avenue and Thirty-eighth Street, New York City, which was recently opened for the exclusive sale of women's, children's and infants' apparel, it was realized that the artificial light must be of the very best. To this end Mr. Alfonse Kaufman, consulting engineer, in co-operation with engineers of the General Electric Company, selected the intensified arc lamp, and it is claimed that the lighting is without question the most remarkable achievement in interior arc lighting to date.

The color value of the light is excellent and the artistic treatment is handsome and unique. When entering most stores illuminated by arc lamps the attention of the customer is usually diverted from the merchandise to the long row of glaring lamps. This objectionable feature is also noticeable in some recent installations in department stores where spherical incandescent lamps are suspended from the ceiling in numberless rows, no consideration being given to the selection of glassware to diffuse the light. Each illuminated sphere plays the part of a spotlight to the eye and is very conspicuous. To avoid this unpleasant effect it is necessary to keep the source of light out of the direct line of vision.

Mr. Kaufman conceived the idea of recessing an arc lamp in the center of each of the false beams forming the bays and, as the ceiling of the first floor is 19 ft. high, it was decided to suspend a hanging arc lamp with bronze ornamental casing in the center of each bay. The object of this arrangement was to have the recessed lamps provide the principal illumination, while the hanging lamps, fewer in number, were to serve mainly as ornaments, since the store would have an unfinished appearance without them. In all, twenty-six recessed and seventeen hanging lamps are installed on the first floor. The arrangement, as outlined, gives a very uniform distribution, and the light shows the true daylight color of the merchandise. The bottoms of the recessed lamps and of the hanging lamps are respectively 17 ft. 6 in. and 11 ft. from the floor.

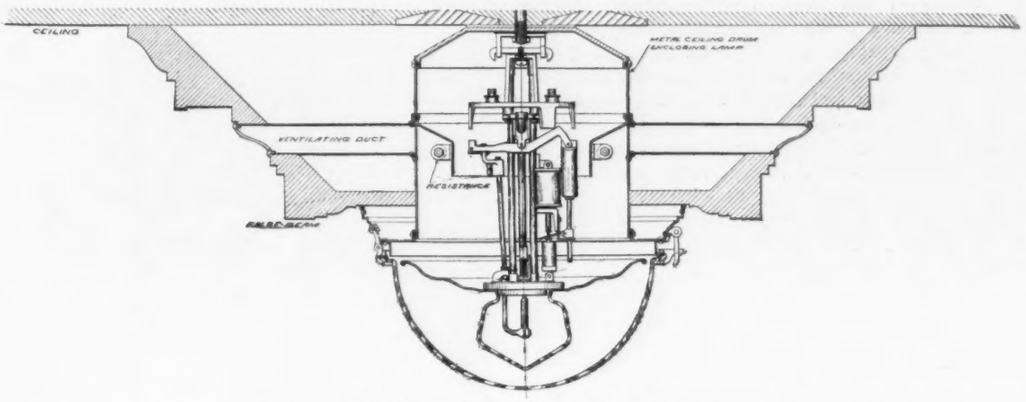


Fig. 1—Section Through Recessed Intensified Arc Lamp.

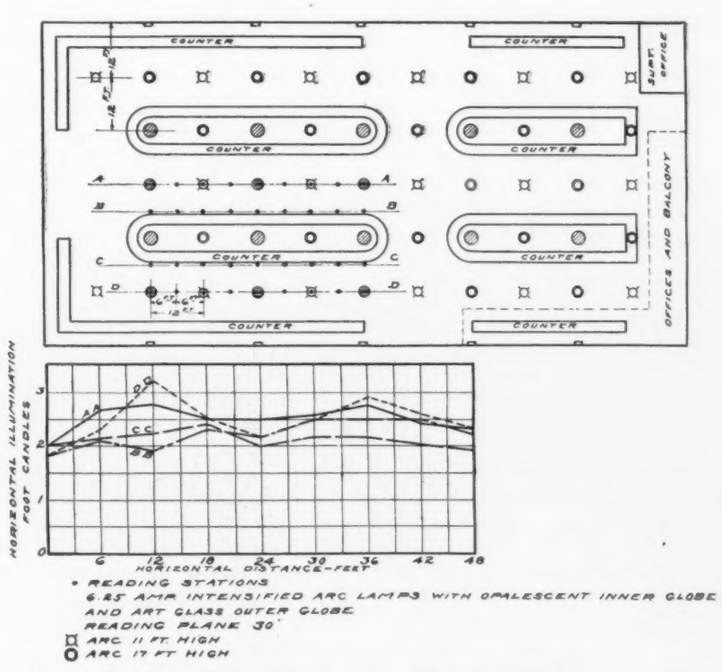


Fig. 2—Intensity of Illumination and Plan of Lighting.

Fig. 3—Pendent Arc Lamp

The recessed lamps are of special design with two vent ducts terminating in a small register. The coils of the lamp, of which there are four, are placed in a ring of spun copper, forming a ventilating chamber so arranged that the heat causes a current of air to pass through the vent ducts at a fairly high velocity, thus preventing any dust from settling on the plaster ceiling. This has proved to work very effectively.

The selection of the glassware was of great importance, and after many trials a light granite opal glass was chosen for the outer globe and an opalescent glass for the inner globe. The granite opal glass is not uniform in color, but is of varying density, this giving a very pleasing effect; in fact, the glass diffuses the light so thoroughly that there is an entire absence of the glare so common with ground glassware. A nickel reflector is provided to throw the light downward.

The lamps were wound specially for about 6¼ amp, in order that higher intensity than that obtained from the commercial lamp might be realized. At first thought the power consumption may be considered high, but the benefit to be derived from having a properly illuminated store

was considered worth manyfold the slight cost of the additional power required. The lamp is supported by a bayonet joint from a cast-iron box embedded in the plaster work of the false beam. The lamp is accessible for repair, and, since the outer globe is hinged, trimming is easily accomplished.

The lighting of the other floors is effected by means of intensified arc lamps in bronze casings, suspended from the ceiling by chains in conventional arrangement. In the French room, where evening gowns are displayed, tungsten-filament lamps set in crystal chandeliers and side brackets are used. Carbon and tungsten-filament lamps are used in the display cases and stockrooms. The worktables are lighted with tungsten lamps fitted with reflectors, one lamp for each operator. The show windows are lighted by means of Holophane-D'Olier steel reflectors set alternately at 30 deg. and 15 deg.

The castings for all arc lamps were made by the Amboy Works, Perth Amboy, N. J., and the arc lamps were made by the General Electric Company.

AN EQUALIZER-SYSTEM HOISTING SET.

The Calumet and Arizona Mining Company has completed an elaborate set of tests on the electric hoisting system which has been in operation at its mine in Bisbee, Ariz., since the latter part of September, 1909. The installation has been highly satisfactory in every respect, and those who have seen it remark on its ease and completeness of control. The tests have shown that, even under severe operating conditions, where the hoist is running a great portion of the time, the average input to the system over a day's run will not exceed 20 to 25 per cent of the maximum load, the rate of input being practically constant.

With small hoists alternating-current induction motors can be applied directly, but where heavy loads are to be handled at high speed the peak due to the acceleration of the rapidly moving parts is always greatly in excess of the average requirements of the hoist. If the supply is obtained from a line carrying a lighting load, the resulting fluctuations of voltage prove most objectionable. In most cases such hoists are at the ends of long transmission lines, so that an excessive amount of copper must be installed to prevent drop in the voltage during maximum demand.

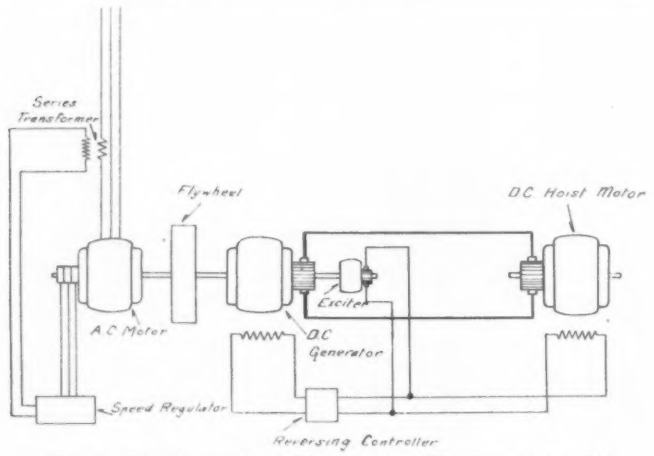


Fig. 1—Arrangement of Circuits for Flywheel-Hoist Set.

The result is that the line must be equipped for peak instead of average load, at a greatly increased expense.

These undesirable conditions have been overcome by the Westinghouse equalizer-system hoisting plant, the essentials of which are diagrammatically shown in Fig. 1. This consists of a direct-current motor, direct-connected to the hoist-drum, and a flywheel motor-generator set which includes a direct-current generator, a laminated flywheel, an alternating-current induction motor and an exciter. The auxiliary equipment comprises a reversing controller for the generator field, a speed regulator, a series transformer and the switchboard.

The hoist at Bisbee was built by the Denver Engineering Works, and it has a normal lifting power of 6000 lb. unbalanced load. Its speed is 1000 ft. per minute, and the ultimate depth of the shaft 1200 ft. The armature of the generator and the hoist motor are directly connected electrically. The field of each machine is excited separately,

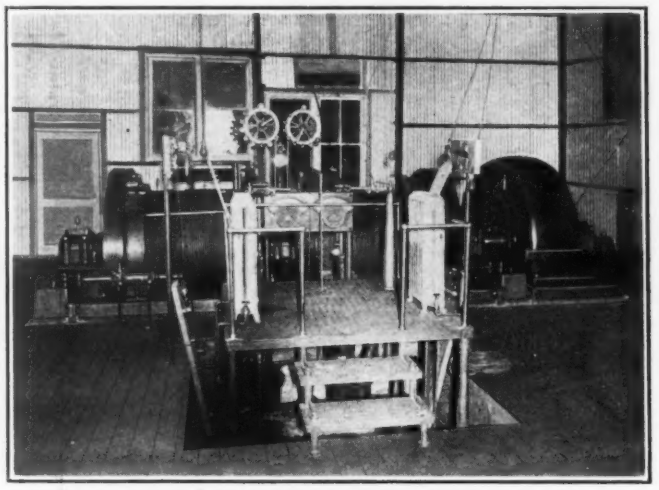


Fig. 2—Hoisting Motor in Mine at Bisbee, Ariz.

constant full-field being maintained in the motor. The hoist is started by gradually increasing the field of the generator and so delivering a proportional voltage to the hoist motor. When the load on the alternating-current motor reaches a certain point resistance is automatically applied to its secondary circuit, reducing the speed of the set so that the energy stored in the flywheel is used to overcome the peak of the hoisting cycle.

The hoist is stopped by gradually weakening the generator field, thus allowing the kinetic energy in the descending cage, the rotating hoist motor and the drums to be returned to the flywheel through the generator, which momentarily acts as a motor, the hoist motor meanwhile serving as a generator.

Over-all efficiencies of hoists of this type are generally from 50 to 60 per cent under normal operating conditions. With these sets it is a simple matter to devise reliable safety devices which do not depend on mechanical brakes. Such devices have been put in practice in Germany, where the government allows men to be hoisted at speeds of 2500 ft. per minute in this type of hoist, although with steam hoists provided with the best available safety devices the maximum speed allowed is but 1200 ft. per minute.

The first cost of such an installation is, of course, somewhat greater than for a small motor hoist with rheostat control, but the reduction of energy cost due to the equalization of the demand is such that the initial expenditure becomes a secondary matter, especially when energy is purchased on a maximum-demand system.

Fig. 2 shows the hoist motor, the drums and the operator's platform at the Calumet & Arizona Company's Bisbee plant, where the set consists of a 220-hp, 550-volt, shunt-wound, commutating-pole, direct-current motor, direct connected to drive the hoist drum at 63 r.p.m. This motor is supplied with power from a flywheel motor-generator set which includes a 180-kw, 575-volt shunt-wound, commutating-pole, direct-current generator, running at 1200 r.p.m.; a 22,700-lb. laminated flywheel, and a 180-hp, 2200-volt, three-phase, 60-cycle, six-pole induction motor for operation at 1020 to 1200 r.p.m. Besides the 15-kw, 125-volt exciter, there are, of course, the necessary controlling and regulating devices, all of the equipment being of Westinghouse manufacture.

Industrial and Commercial News

THE WEEK IN TRADE.

APPROACH of the holidays resulted this week in mild contraction in many lines of business, but this condition is regarded as only temporary. As stocks are low in more than one branch of industry and prices attractive, and commercial interests in general are diverting their attention from political matters to methods of securing new business, the outlook for the coming year is considered very favorable. Much of the briskness shown in the steel trade in the last few weeks has been checked by the nearness of the holiday season, but a large amount of good business is in sight, and much of this, it is hoped, will be closed within the next few weeks. Steel orders this week, while numerous, were chiefly in small lots, with those for railroad equipment predominating. Few contracts of importance for pig-iron have been placed since last report. In both of these branches, however, there are sufficient orders on hand to assure activity for some time to come. Resumption of operations at several tin mills that had lain idle for many months was an encouraging incident of the week. Slight increases are being shown in the tonnages carried by the railroads, indicating gradual return to normal conditions. Another favorable influence in the trade situation was the final crop report for the year, issued on Monday by the Department of Agriculture. This placed the total value for the eleven important farm crops, not including cotton, at $3,769,562,000, an increase of nearly $190,000,000 over the 1910 total. Business failures for the week ended Dec. 14, as reported by *Bradstreet's*. were 309, as compared with 267 last week, 290 in the corresponding week in 1910, 273 in 1909, 311 in 1908, and 300 in 1907.

THE COPPER MARKET.

FOLLOWING announcement of the November report of the Copper Producers' Association, a campaign for higher prices began, with 14-cent copper as the slogan. This figure has been freely quoted by the leading agencies during the week, though fractional concessions have been made. Most of the sales of electrolytic in the past few days have been made at 13⅞ cents, cash, and at 14 cents for thirty days. The domestic market became very animated upon the first advances in price, and substantial sales were made at the higher figures. Under constant forcing, however, interest has waned, and the upward movement has reacted upon itself for the time being. Very little future business developed this week, and most of the orders placed in the past few days had been pending for some time. Standard copper has been very active both in London and New York, and prices have been very irregular, declining slightly in the middle of the week. The fortnightly statistics showing stocks of standard copper in Great Britain and France as of Dec. 15 reported a decrease of 1,263 tons as compared with the total on hand Nov. 30, this reduction bringing the supply to 127,088,640 lb. Estimates on the December report of the Copper Producers' Association are being made, and many in the trade are expecting a showing even more favorable than that in November as regards reduction of surplus stocks. Exports during the week have been heavy, and shipments for the month, including Dec. 20, aggregate 23,426 tons. The daily call on the Metal Exchange Dec. 20 quoted copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	13.87½	14.10	.....
December	13.92½	14.00	13.92½
January	14.00	14.25	14.12½
February	14.00	14.37½	14.17½
March	14.00	14.37½	14.17½
April	14.00	14.37½	14.17½

The London market Dec. 20 was as follows:

	Noon. £	s	d	Closing. £	s	d
Standard copper, spot	62	10	0	63	7	6
Standard copper, futures	63	10	0	64	10	0

Extreme fluctuations for this year.

	Highest.	Lowest.
Standard	13.92½c	11.57½c
London, spot	£63 10 0	£53 7 6
London, futures	63 10 0	54 0 0
Best selected	67 10 0	57 5 0

INDUSTRIAL AND COMMERCIAL NOTES.

Electric Motors for Steel Works.—The Youngstown Sheet & Tube Company, of Youngstown, Ohio, has recently placed an order with the Westinghouse Electric & Manufacturing Company for a total of ninety-nine motors to be used in connection with its open-hearth plant. They will be used on cranes, charging machines, strippers, transfer tables, screw-downs and blooming mills. The Youngstown company formerly used the Bessemer process, and is now installing the open-hearth process with a blooming mill for taking care of the process output. An interesting point of this order is that fifty-six of these motors are the new Westinghouse direct-current mill-type motor equipped with commutating poles. This line has been designed to parallel the company's well-known alternating-current motor, which has proved so successful in mill service.

Long Acre Case Up Again.—The Public Service Commission for the First New York District and the Long Acre Electric Light & Power Company have asked for a dismissal of the writ of certiorari obtained by the New York Edison Company to review the proceedings under which permission was given to the Long Acre company to issue $4,000,000 in bonds and $2,000,000 in stock after a long fight by the latter to establish the validity of the franchise giving it right to operate in New York City. Counsel for the New York Edison Company, in asking the court to sustain the writ, stated that "the case is a proper one for the court to establish the precedent that no issue of securities shall be approved until the Public Service Commission has decided in the applicant's favor upon the question of public necessity and convenience." Decision was reserved.

East Tennessee Power Company's Plant Nearing Completion.—The East Tennessee Power Company, which is now completing the equipment of a large plant station on the banks of the Ocoee River near Parksville, Tenn., expects to furnish energy to Knoxville, Tenn., by Jan. 15. The big dam across the Ocoee is practically completed and nearly all the dynamo and turbine equipment of the station is installed and ready for use, so that lines from the dam to Knoxville and Chattanooga may be extended within thirty days. The energy generated will aggregate about 35,000 hp. Franchises have been awarded to the East Tennessee company by practically every city and town within a considerable radius.

New Telephone Company in Pennsylvania.—It is announced that an application will be made on Jan. 8 for the charter of a new company to be known as the North American Telephone & Telegraph Corporation. The purposes of the proposed company are said to be the construction, buying, leasing and operating of telephone and telegraph lines and the maintenance of a general telephone and telegraph business.

Water-Power Merger at Halifax.—A new company is being formed with a capital of $6,000,000 to take over the various water-power companies operating on the Mersey and Gaspereau Rivers in Nova Scotia. The Halifax Electric Tramway Company will be included in the merger. The new company plans to transmit energy to Halifax and to other localities in the western part of the Province.

New Turbine Equipment for Warren, Ohio.—The Trumbull Public Service Company, of Warren, Ohio, recently formed to take over a number of Ohio properties and in which H. L. Doherty, of New York, is interested, has ordered a 1500-kw, three-phase, 60-cycle Allis-Chalmers turbine equipment and a 500-hp Erie City boiler. The new equipment will be installed in the steam station at Warren.

Chilean Possibilities.—F. C. Enright, the South American representative of the Chicago Association of Commerce, made a trip to Chile recently and, among other things, he reports that there is some demand for electrical appliances and electric signs in that country.

United Wireless Meeting.—About 130 stockholders of the United Wireless Telegraph Company met in New York, Dec. 16, to discuss plans for reorganization of the company in accordance with plans outlined in these columns in the previous issue. A rather lengthy discussion took place upon nominations for a committee to investigate the facts in the case, and A. P. West, R. M. Owen, F. G. Lee and R. H. Armstrong, of Seattle, Wash., were finally appointed for the purpose. A statement of the financial condition of the company as of Nov. 20 was read, and this showed assets of $505,673 and liabilities of $45,328. It was stated that $300,000 will be needed to put the company's affairs in a satisfactory condition, pay off debts, meet obligations for $75,000 that was raised for carrying on the business, and furnish $100,000 working capital. According to the views of counsel for the trustees, from three to six months will be required to take the company out of bankruptcy.

French Broad (N. C.) Hydroelectric Plant Completed.—The new power plant of the North Carolina Electrical Power Company, which has been in the course of construction just below the town of Marshall, near Asheville, N. C., for the past two years, has been finished, and the plant of the Champion Fibre Company, at Canton, 27 miles away, is now being run by electrical power. The plant is situated on the French Broad River and represents an expenditure of $500,000. Contracts have been signed whereby the new plant is to furnish electrical power for a number of the towns of the western part of North Carolina. The plant has a capacity of 5500 hp.

Public Service Company of Northern Illinois.—The recently formed Public Service Company of Northern Illinois has given a mortgage to the Illinois Trust & Savings Bank, of Chicago, for $13,459,000. This mortgage covers all the properties of the company and secures an issue of first-mortgage gold refunding 5 per cent bonds issued in denomination of $1,000. The mortgage was dated Oct. 1, 1911, but was not recorded until Dec. 12. The bonds will be used to refund the bonds and notes of the various companies merged into the new company.

Automatic Telephone Company for England.—Announcement is made of the registration in England of the Automatic Telephone Manufacturing Company, Ltd., with a capital of £1,000,000, divided into 1,000,000 shares of £1 each, half of which are 6 per cent preferred stock. The new company will acquire from the Automatic Electric Company, of Chicago, certain patents for inventions relating to automatic telephone service, and from the British Insulated & Helsby Cables, Ltd., certain lands at Edge Lane, Liverpool, England.

Dividends of Louisville Companies.—The Louisville Lighting Company, which is controlled by the Louisville Gas Company, has declared a 2 per cent semi-annual dividend payable Jan. 1. The dividend is payable on a capitalization of $3,000,000, and follows a payment of equal amount last June after several dividends had been passed. The Louisville Gas Company has also put its stock upon a dividend basis, announcing a 3 per cent payment to shareholders.

Toledo Railways & Light Company Valuation.—Frank B. Ford, of Ford, Bacon & Davis, New York City, has been selected by officials of the Toledo Railway & Light Company to assist John M. Killits and Edward W. Bemis, the city's representatives, in placing a value upon the company's property for use in the franchise negotiations now pending.

New Steam Auxiliary Plant at Sacramento, Cal.—Contracts have been awarded for the erection of a new steam auxiliary plant at Sacramento, Cal., by the Pacific Gas & Electric Company. This plant will have a rated output of about 12,500 kw, and the cost for the building, exclusive of machinery, will be about $56,000.

Georgia Railway & Power Securities.—The Georgia Railroad Commission has approved the $47,000,000 stock and bond issue of the Georgia Railway & Power Company, which was organized, as stated in these columns Sept. 23, to acquire a number of public utilities in the State of Georgia.

Aluminum Notes and Prices.—The aluminum market continues to be very quiet. Quotations, Dec. 19, held ingots for remelting at 18½ to 19½ cents, rods and wire at 31 cents, and sheets at 33 cents. London prices, Dec. 6, placed ingots at 13 cents, wire at 22 cents and sheets at 25 cents.

Ohio Hydroelectric Development.—A company has been formed to improve water-powers on the Big Miami River at Woodsdale, Ohio, for electrical generating purposes. It is estimated that 5,000 hp can be developed at this site.

Financial.

The Week in Wall Street.

TRADING on Monday was very quiet as compared with that on the closing days of the previous week, and declines of over a point from Saturday's quotations were made in several of the leading issues. Although the final government report on the yield of the more important cereals was made public, and showed very favorable results, it was not of sufficient moment to check the reaction of the market. The only feature of interest was a slightly easier tone in the money market. Announcement of a receivership for the Wabash Railroad did not figure as a market factor on Tuesday, nor did the shares of the company experience severe loss in consequence of the announcement. The volume of trading declined still further from that on the preceding day, but prices, after irregularity in the earlier transactions, became firmer, and numerous gains were made, including a one-point advance in United States Steel common. Shipments of gold to South America were the chief development in the money market. Price changes on Wednesday were very few in number, and trading throughout the day was exceedingly irregular. The Census Bureau's report on cotton ginning from Dec. 1 to Dec. 13, which was issued on Wednesday, showed that 13,759,652 bales had been ginned in that time as compared with 10,695,443 bales in the corresponding period of 1910, and it was favorably received. Failure of the Lehigh Valley directors to announce a special dividend, contrary to general expectation, was the most conspicuous incident of the day, and resulted in a decline of nearly a point in the stock. Rates in the money market, Dec. 20, were: Call, 3¾@4 per cent; ninety days, 4@4½ per cent. The quotations in the tables are those at the close Dec. 20.

NEW YORK.

	Dec. 13.	Dec. 20.	Shares Sold.		Dec. 13.	Dec. 20.	Shares Sold.
All. Ch.....	1⅞	1½*	5,650	Int. Met., pf.	48	48¾	14,700
All. Ch., pf..	8	8	1,600	Mackay, Cos.	81½*	82*	200
Amal. Cop...	64⅝	66⅜	127,290	Mackay C.,pf.	72⅜*	72*	200
Am. D. T...	33⅛*	33⅛*	——	Man. Elev...	136	134	300
Am. Loco....	37	37	1,400	Met. St. Ry.	15*	15*	——
Am. Loco.,pf.	103	104*	125	N.Y.&N.J.Tel.	139½*	139½*	——
Am. Tel. & C.	78*	78*	——	Steel, com...	66⅜	68⅝	988,364
Am. T. & T..	140	139⅞	9,630	Steel, pfd....	110⅞	111⅜	15,002
B. R. T.....	76¾	77¼	7,100	W. U. T....	79	78¾	18,600
Gen. Elec....	154¼	155	2,700	West'h, com.	66	68¾	6,760
Int. Met.....	15¼	15⅜	6,600	West'h, pfd..	113*	117½	——

PHILADELPHIA.

	Dec. 13.	Dec. 20.		Dec. 13.	Dec. 20.
Am. Rys.....	45½*	45¼	Phila. R. T.....	23	23½
El. Co. of A.....	12	12⅛	Phila. Elec.....	15¾	16¾
Elec. St. Bt'y.....	54½	54⅜	Phila. Trac.....	84½	84½
Elec. St. Bt'y., pf..	30*	30*	Union Trac.....	51¼	51¼

CHICAGO.

	Dec. 13.	Dec. 20.		Dec. 13.	Dec. 20.
Chi. City Ry.....	186*	186*	Com. Edison.....	135½	135¼
Chi. Elev. Rys.....	29*	30⅜*	Chi. Subway.....	...	⅞
Chi. Elev. Rys., pf.	94*	92*	Chi. Telephone....	139	†137¾
Chi. Rs., Ser. 1....	95*	99	Nat'l Car.....	103	103*
Chi. Rs., Ser. 2....	34⅝	37½	Nat'l Car, pfd.....	118	118*

BOSTON.

	Dec. 13.	Dec. 20.		Dec. 13.	Dec. 20.
Am. T. & T.....	140	140	Mex. Tel.....	3¼*	3¼*
Cum. Tel.....	157	156½	Mex. Tel., pf.....	6½	6½*
Edison	292	295	N. E. Tel.....	163¼	157
Gen. Elec.....	154	155	W. T. & T.....	27½*	27½*
Mass. E. Ry.....	21⅝	22¾	W. T. & T., pfd....	64¼*	64¼*
Mass. E. Ry., pf....	93½	95¼			

*Last price quoted.
†Ex-dividend.
Shares sold for the week, Dec. 11 to Dec. 16.

Financial Notes.

Chicago Railways Bonds.—New York and Chicago banking interests are offering $6,000,000 consolidated-mortgage, series A, 5 per cent gold bonds of the Chicago Railways Company. The bonds are in denomination of $1,000, are dated Feb. 1, 1907, and are due Feb. 1, 1927, with interest payable April 1 and Oct. 1 in New York or Chicago. A letter from Henry A. Blair, chairman of the board of directors of the company, to the bankers offering the bonds, states that the company owns and operates without surface competition 460 miles of electric railway, measured as single track, serving the downtown districts as well as the entire North and West Sides of the city. The capitalization of the company, as of Jan. 5, 1912, is given as follows: First-mortgage 5 per cent bonds issued to date, $45,955,000; series A consolidated-mortgage bonds, $16,359,800; purchase-money bonds, series B and C consolidated-mortgage bonds and

adjustment income bonds, $26,099,911. Except for $1,006,200 series A bonds reserved for the acquisition of additional property, as stated below, the series A mortgage is now closed. The capital stock of the company has been made the basis of an issue of four series of participating certificates. The $16,359,800 outstanding series A bonds include $498,000 of the $832,000 series A bonds which are deposited to secure the payment of $498,000 5 per cent collateral-trust notes due Feb. 1, 1913, and not subject to call. In addition to the above, $1,006,200 series A bonds are held in the treasury of the company, which may be issued if deemed advisable by the company, but only for the acquisition of additional property. On the principal trunk lines and those covering the downtown district and on all other property of the company except 128 miles of track in the outlying districts recently acquired, the lien of the mortgage securing the series A bonds is subject only to that of the first mortgage. The company's franchise runs until Feb. 1, 1927, and grants the city the option to purchase all of the property for municipal ownership and operation at any time during the life of the franchise for an amount equal to the original valuation fixed by the franchise ordinance, plus the cost of construction and rehabilitation since Feb. 1, 1907, including any amounts which may be advanced to the city for the construction of subways in the downtown business district. The city is entitled to 55 per cent of the surplus earnings after first providing for all operating expenses, including taxes and full charges for maintenance and depreciation and 5 per cent per annum upon the official valuation. Gross earnings in the year ended Oct. 31, 1911, were $16,671,315; operating expenses, including taxes and renewal fund required by ordinance, were $11,678,771, leaving net earnings $4,992,543. The annual interest charge on the first-mortgage fives was $2,297,750; annual interest charge on 5 per cent, series A bonds was $817,990, and annual interest charge on purchase-money bonds was $162,920, making total charges of $3,278,660; the balance applicable to payment of interest on junior securities and percentage of surplus earnings to the city of Chicago was $1,713,883.

Kings County Electric Light & Power Company's Statement.—The combined statement of the Kings County Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn, for November, and for eleven months ended Nov. 30, 1911, compares very favorably with that for the corresponding periods in the previous year. Gross earnings in November, 1911, were $454,190, as compared with $403,933 in November, 1910, an increase of $50,257. Operating expenses, including general, technical, production and distribution expenses, were $197,111, as compared with $178,780, an increase of $18,331. Net earnings were $257,079, as contrasted with $225,153, a gain of $31,925. Bond discount written off was $1,689, leaving balances of $255,390 and $223,464, respectively. Depreciation was $64,052 in November, 1911, and $52,890 in November, 1910. Fixed charges, including bond and interest on unfunded debt, were $70,546, as compared with $63,198, leaving a profit and loss surplus for the month of $120,791, as compared with $107,376, a gain of $13,414. The statement covering operations from Jan. 1 to Nov. 30, 1911, inclusive, shows gross earnings of $4,309,408, as compared with $3,905,675, an increase of $403,733 over the gross in the corresponding period of the previous year. Operating expenses, including general, technical, production and distribution expenses, were $2,130,049, as against $1,871,307, an increase of $258,741, and net earnings were $2,179,358, as compared with $2,034,367, a gain of $144,991. Bond discount was $18,579, depreciation charges were $538,323 and $476,155 respectively, and fixed charges were $734,222, as compared with $669,296. These deductions left a profit and loss surplus of $888,232 for the eleven months ended Nov. 30, 1911, as compared with $870,335 in the corresponding period of 1910, a gain of $17,897.

Platt Iron Works Company Affairs.—The trustees of the Platt Iron Works Company, Dayton, Ohio, have issued a statement relative to reports circulated to the effect that the Dayton plant is to be shut down and the business discontinued. Such reports are denounced as without foundation and absolutely untrue. Under the order of the court, it is stated, the business is to be continued and, when sold, is to be sold as a going concern. On Aug. 5 the receivers of the Platt Iron Works Company sent out a letter setting forth that the placing of the company in the hands of receivers, while unavoidable, was the first step toward a reorganization. At a meeting of a majority of the creditors, on Nov. 20, trustees were elected, who are now in charge of the property, with full authority to conduct and carry on the business, which has been in existence for a period of over thirty years, during which time it has built up, in addition to a thoroughly modern plant, a valuable asset in the form of good-will, and at the present time has so large a quantity of work on hand as to require upward of 750 employees. It is stated that the organization, including the engineering, sales and mechanical departments, remains intact, and that the property is and has been operated on a profitable basis. In conclusion the statement says that any business intrusted to the trustees will receive the very best attention and that extraordinary effort is being put forth to give the very best possible service in the repair department, which is recognized to be so important to patrons.

Philadelphia Rapid Transit Report.—At the meeting of the board of directors of the Philadelphia Rapid Transit Company, Dec. 18, the report of operation for the month of November and for the five months of the fiscal year to Nov. 30, 1911, was submitted and approved. The November report gave gross passenger earnings as $1,804,353, an increase of 6.07 per cent over those in November, 1910; receipts from other sources were $77,621, an increase of 9.31 per cent, and total earnings were $1,881,975, an increase of 6.2 per cent. Operating expenses were $1,136,731, leaving net earnings from operation of $745,254. Fixed charges were $740,631, leaving a surplus for the month of $4,623. Gross passenger earnings in the five months of the fiscal year to Nov. 30, 1911, were $8,971,466, an increase of 5 per cent; receipts from other sources were $408,669, an increase of 16.93 per cent. Total gross earnings were $9,380,136, an increase of 5.47 per cent over those in the same period in the previous fiscal year. Operating expenses were $5,690,194 and net earnings from operation $3,689,942. Fixed charges were $3,688,821, leaving a surplus of $1,120 for the period. Completion of a number of extensions promised by E. T. Stotesbury, chairman of the board of directors, in a letter under date of April 10, 1911, to the chairman of the financial committee of the City Council was announced, and a number of important changes in operation, effective Jan. 1, 1912, were also made public.

New Interborough Bonds Approved.—The Public Service Commission for the First New York District has authorized the Interborough Rapid Transit Company to issue $12,755,000 forty-year 5 per cent first-mortgage bonds, payable Nov. 1, 1952, or on any interest day, at 105 and accrued interest. The company has applied for permission to issue $17,123,611 at this time, and further hearings will take place on the question of authorizing the balance between this total and the $12,755,000 authorized. The bonds are secured by a first mortgage for $55,000,000 authorized April 23, 1908, under which $30,552,000 had been issued, and the new issue brings this to a total of $43,302,000. Proceeds from the new issue will be used for meeting outstanding notes and for general refunding purposes and improvements.

Toledo Railways & Light Extension.—The Toledo Railways & Light Company has arranged with Blair & Company, New York, for extension to Jan. 1, 1913, with interest at 6 per cent, of the time of payment of the Toledo Traction Company's consolidated first-mortgage bonds due Jan. 1, 1912, and the Toledo Electric Street Railway Company's first-mortgage bonds due Feb. 1, 1912. Holders of these bonds who do not wish to take advantage of this extension will receive par in cash for their bonds upon delivery at maturity. The extension privilege for the Toledo Traction and the Toledo Consolidated bonds expires on Dec. 28, and for the Toledo Electric Street Railway on Jan. 28.

Sheboygan (Wis.) Railway & Electric Company Sold to New Jersey Interests.—It is announced that controlling interest in the Sheboygan Railway & Electric Company, of Sheboygan, Wis., has been acquired by F. W. Roebling, of Trenton, N. J. The company operates an interurban line 33 miles in length between Sheboygan, Sheboygan Falls, Plymouth and Elkhart Lake, and furnishes energy for the local lighting and power service. It is successor to the Sheboygan Light, Power & Railway Company.

Springfield Street Railway Financing.—The Springfield Street Railway Company, of Springfield, Mass., has presented a petition to the Railroad Commissioners asking permission to issue $200,000 4 per cent twenty-year gold bonds, under date of April 1, 1903. Authority was granted in that year to issue $1,700,000 bonds, and $1,500,000 was issued under that authority. The proceeds of the $200,000 now applied for will be used for meeting indebtedness arising from cost of improvements that have been made to the properties of the company.

Southern California Edison Bonds Offered.—A Boston banking house is offering general mortgage 5 per cent gold bonds of the Southern California Edison Company, a corporation organized under California laws and owning and operating the gas and electric properties formerly owned by the Edison Electric Company of Los Angeles, serving a population in excess of 600,000. The capitalization of the company is as follows: Preferred stock authorized and issued, $4,000,000; common stock authorized, $26,000,000, issued, $7,900,000; debentures authorized and issued, $1,000,000; general mortgage 5 per cent bonds authorized, $30,000,000, issued, $9,336,000; closed mortgages, $8,898,000, from which is deducted $4,674,000 held by trustee as additional security to the general mortgage 5's, leaving a balance of $4,224,000 outstanding in the hands of the public. The company generates the greater part of its energy in hydroelectric plants, the largest hydroelectric development being that known as Kern River No. 1, which is rated at 30,000 hp and transmits energy to Los Angeles, a distance of 116 miles. The company is also operating hydroelectric stations of 12,000-hp capacity in the Santa Ana, Lytle Creek and Mill Creek cañons. It also has steam generating stations at Los Angeles, Pasadena, San Bernardino, Redlands, Long Beach and Santa Monica, with a combined capacity of 34,000 hp. The total capacity of the company's stations at present is approximately 75,000 hp, and additional capacity will be provided as required by installation of units in the Long Beach station, which was described in these columns May 11 of the present year. Gross earnings of the company in the year ended Oct. 31, 1911, were $3,659,786, as compared with $3,329,094 in the year preceding. Operating expenses, including taxes, maintenance and renewals, were $1,792,089, as compared with $1,643,246, and net earnings in each of these two years were $1,867,696 and $1,685,847 respectively, representing this year more than two and three-quarters times the $678,630 interest on $13,560,000 bonds. Deduction of this interest left a balance of $1,189,066, from which was taken $60,000 interest on debentures, and $680,000 for depreciation, leaving a balance of $449,066 for the year's operations. The connected load in incandescent lamps in 50-watt equivalent, as of Oct. 31, 1911, was 1,208,946; the number of motors was 4,902, aggregating 70,994 hp, and there were 64,169 electric meters on the lines. Substantial gains were made in these items during the year. The preferred stock of the company is 5 per cent cumulative, and the common stock is now paying 5 per cent. The bonds are offered at 96½ and interest, to yield 5¼ per cent.

Washington, Baltimore & Annapolis Company's Earnings.—The November statement of the Washington, Baltimore & Annapolis shows gains in both gross and net income. Gross operating revenue for the month was $56,119.67, as contrasted with $53,441.82 in November, 1910, a gain of $2,677.85, and operating expenses were $28,954.51, as compared with $29,798.47, a decrease of $843.96. Net operating revenue was $27,165.16, as against $23,643.35, an increase of $3,521.80. The total gross income for November, including miscellaneous income, was $27,550.34, as against $23,768.72 for the preceding November, a gain of $3,781.62. Deductions from income, including interest, taxes, etc., amounted to $22,114.52, as compared with $30,152.45, a decrease of $8,037.93, leaving a net income of $5,435.82, as against a deficit of $6,383.73 in November, 1910. The percentage of operating expenses to gross operating revenue was 51.59 per cent, as compared with 55.75 per cent in November, 1910. Gross operating revenue of the company for eight months ended Nov. 30 was $495,108.65, as against $487,698.41 in the corresponding months of the preceding fiscal year, an increase of $7,410.24. Operating expenses for the period were $234,315.95, as contrasted with $237,696.04, a decrease of $3,380.09, making the net operating revenue $260,792.70, as against $250,002.37, a gain of $10,790.33. Gross income for the eight months, including miscellaneous income, was $262,535.62, as compared with $251,282.69, a gain of $11,270.93. Interest, taxes, etc., amounted to $117,700.77, leaving a net income of $84,852.85, as against $4,590.56 for the corresponding period of the previous fiscal year. The percentage of operating expenses to gross operating revenue was 47.32 per cent, as contrasted with 48.74 per cent. From the record made by the company during the eight months of the fiscal year it can be seen that the predictions of a surplus of $100,000 for the fiscal year, which ends March 30, 1912, made by President George T. Bishop when the reorganization plan was put into effect, will probably be more than realized. With four months of the fiscal year yet to be reported, the company has so far earned a surplus of $84,652.85, which is just about $3,000 short of the 6 per cent dividend on its $1,460,000 preferred stock. President Bishop recently came to Baltimore to inspect the company's property, and expressed himself as being well satisfied with the showing that has been made.

Postal Telegraph-Cable to Build Lines for Use of Independent Telephone Companies.—Minor M. Davis, who was recently appointed superintendent of telephones of the Postal Telegraph-Cable Company, announced Dec. 20 that his company had issued instructions to its construction department to proceed with the erection of additional heavy copper wires between all important points on the system of the company for the purpose of extending the telephonic use of the same to the independent telephone companies.

Brooklyn Rapid Transit Gains.—During the first half of December gross earnings of the Brooklyn Rapid Transit Company increased at rate of $4,000 per day, which compares with an average of $3,000 in November and $2.800 in October. Even greater improvement is expected in the totals for the second half of the month owing to holiday traffic.

DIVIDENDS.

American Cities Company, initial semi-annual, preferred, 3 per cent, payable Jan. 2.

American Gas & Electric Company, quarterly, 1½ per cent, payable Jan. 2.

American Power & Light Company, quarterly, preferred, payable Jan. 2.

American Telephone & Telegraph Company, $2 per share, payable Jan. 15.

Buffalo General Electric Company, quarterly, 1½ per cent, payable Dec. 30.

Carolina Power & Light Company, quarterly, preferred, 1¾ per cent, payable Jan. 20.

Chattanooga Railway & Light Company, quarterly, preferred, 1¼ per cent, payable Jan. 2.

Cincinnati Gas & Electric Company, quarterly, 1¼ per cent, payable Jan. 1.

Dayton Power & Light Company, quarterly, preferred, 1½ per cent, payable Jan. 15.

Detroit Edison Company, quarterly, 1¾ per cent, payable Jan. 15.

Electrical Utilities Corporation, quarterly, preferred, 1¼ per cent, payable Jan. 15.

El Paso Electric Company, semi-annual, preferred, $3 per share, payable Jan. 8.

Louisville Lighting Company, semi-annual, 2 per cent, payable Jan. 2.

Manila Electric Railroad & Lighting Corporation, 1½ per cent, payable Dec. 30.

Western Electric Company, quarterly, $2 per share, and an extra dividend of $2 per share, payable Dec. 30.

Western Union Telegraph Company, quarterly, three-fourths of 1 per cent, payable Jan. 15.

REPORTS OF EARNINGS.

ATLANTIC CITY ELECTRIC COMPANY.

Period.		Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
November,	1911.....	$33,770	$13,906	$19,864	$8,506	$11,358
November,	1910.....	30,085	15,000	15,085	6,736	8,349

BUFFALO GENERAL ELECTRIC COMPANY.

10 m., Oct.,	1911....	$969,675	$611,919	$398,205	$125,563	$272,642
10 m., Oct.,	1910.....	867,526	531,095	369,537	111,512	258,025

KINGS COUNTY ELECTRIC LIGHT & POWER COMPANY.

November,	1911.....	$454,190	$197,111	$257,079	$136,288	$120,791
November,	1910.....	403,933	178,780	225,153	117,777	107,376
11 m., Nov.,	1911.....	4,309,408	2,130,049	2,179,358	1,291,126	888,232
11 m., Nov.,	1910.....	3,905,675	1,871,307	2,034,367	1,164,032	870,335

MUNCIE ELECTRIC LIGHT COMPANY.

November,	1911.....	$33,126	$16,685	$16,441	$6,076	$10,365
November,	1910.....	29,039	17,406	11,633	4,438	7,195

ROCKFORD ELECTRIC COMPANY.

November,	1911.....	$38,400	$18,250	$20,150	$7,729	$12,421
November,	1910.....	35,697	19,487	16,210	6,722	9,488

SCRANTON ELECTRIC COMPANY.

November,	1911.....	$72,819	$29,167	$43.643	$11,681	$31,962
November,	1910.....	67,086	26.621	40,465	9,269	30,196

General News

Construction News.

MONTGOMERY, ALA.—The Board of City Commissioners has authorized Commissioner E. B. Joseph, in charge of the Water Works Department, to purchase a new electric compressor, to cost about $16,500.

KINGMAN, ARIZ.—The Supervisors of Mohave County have granted the Aracy Engineering Company a franchise to operate on various places on the Colorado River in the vicinity of Kingman, especially in the vicinity of the McCracken mines. A large hydroelectric plant will be built on the Colorado River and will supply electricity to the McCracken mines and other properties in this vicinity.

ALAMEDA, CAL.—It is reported that no bids were submitted to the City Council on Dec. 5 for the erection of electroliers. The work will be done by the managers of the municipal electric-light plant. F. E. Browning is city clerk.

BAKERSFIELD, CAL.—The city clerk is advertising for bids for the installation of a street-lighting system to consist of about 200 luminous arc lamps and energy for same with an all-night service.

BEAUMONT, CAL.—T. J. Barker and C. L. Nye, of Riverside, Cal., have acquired the Highland Home Ranch, in Beaumont, and propose to install a power plant.

BODIE, CAL.—The Crystal Lake Gold Mining Company has commenced work on the reconstruction of its electric-power plant, which was destroyed by a snowslide early in 1911.

CHICO, CAL.—B. F. Hudspeth, clerk, it is reported, has been instructed to advertise for proposals for electricity for lighting the streets of the city for a period of three years. Energy used for the electroliers will be on the meter system and will be included in the contract.

FRESNO, CAL.—Funds are being raised by the property owners on K Street and Van Ness Avenue for the installation of an electrolier lighting system with bronze columns, to cost approximately $100 each.

FRIANT, CAL.—The Pacific Light & Power Corporation, of Los Angeles, has commenced work on the survey for an electric railway from Friant to a point near Shaver, the site of its Big Creek hydroelectric power plant, a distance of about 50 miles. The cost of the proposed railway is estimated at about $1,000,000. The Stone & Webster Engineering Corporation, of Boston, Mass., is in charge of the work. J. M. Thebo is chief engineer for the company.

LOS ANGELES, CAL.—The Southern California Edison Company is erecting a new transmision line from a point near Los Angeles to Van Nuys.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has been granted permission by the Board of Public Utilities to equip the Southern Pacific line from Sentous to Los Angeles, a distance of about 8 miles, for electrical operation.

LOS ANGELES, CAL.—The City Council has granted a franchise to W. P. Story to construct a tunnel beneath the city streets from the Story Building to the Garland Building for the purpose of furnishing electricity and heat from the power plant located in the Story Building.

LOS ANGELES, CAL.—The Arctic Mining & Power Company has called a special meeting of the stockholders to be held Feb. 6, 1912, to vote on the proposition to increase the capital stock of the company from $500,000 to $1,000,000, the proceeds to be used for extensions and improvements to its system. J. P. Flint is secretary.

LOS ANGELES, CAL.—The Wright & Callender Building Company has made application for a permit to construct a conduit connecting its power plant in its office building located at Fourth and Hill Streets with the new office building of the Black Fireproof Building Company, now being erected on the opposite corner, for the purpose of furnishing light, heat and power to the new building.

OROVILLE, CAL.—The Oro Electric Light & Power Company has appropriated $7,000,000 for the construction of a large dam near Belden, work on which will begin next April. It is estimated that about 50,000 hp can be developed. The company, it is said, proposes to supply water and power to irrigate 10,000 acres in the vicinity of Oroville. Pumps will be used for irrigation purposes. R. Leo Van der Naillen, manager, will have charge of the work.

PASADENA, CAL.—The City Council has authorized an expenditure of about $1,500 for fuel-oil operating supplies and construction material for the municipal electric-light plant. C. W. Koiner is general manager.

PORTERVILLE, CAL.—Application has been made to the City Council by the Tulare County Power Company, recently organized, for a fifty-year franchise to erect and operate an electric distributing system in Porterville.

REDDING, CAL.—The Mammoth Copper Company is contemplating the construction of a surface tramway system, with ore cars operated by electric motors. The cars will have a capacity of 25 tons each.

SACRAMENTO, CAL.—The State Board of Control will soon call for bids for about 25,000 electric lamps of various sizes to be used in the State institutions during the year 1912.

SAN BERNARDINO, CAL.—Negotiations have been closed whereby the Southern Sierras Power Company has acquired the property of the Lytle Creek Power Company, San Bernardino, and the Corona Gas & Electric Company, of Corona. These companies supply electricity for lamps and motors to all cities and towns in San Bernardino and Riverside Counties and numerous irrigation projects. The Southern Sierras Company is planning to erect a transmission line 70 miles long, to connect Corona and San Bernardino with several nearby towns. The Sierras company is a subsidiary of the Nevada-California Power Company.

SANTA ROSA, CAL.—The California Telephone & Light Company, recently incorporated with a capital stock of $10,000,000, will take over the plant and holdings of the Northwestern Electric Company, the Russian River Light & Power Company, the Sonoma Valley Company and the Clear Lake Consolidated Company; also, the Healdsburg Telephone Company, the Valley Telephone Company, the Cotati Company and other companies operating rural telephone lines. The Bennett Valley telephone lines will be rebuilt and the service improved. The company also proposes to erect an electric transmission line through Bennett Valley to supply electricity in many places in the valley. A transmission line will also be erected to Cotati and throughout the Cotati section. The California Telephone & Light Company obtains electricity for its systems from the Pacific Gas & Electric Company and from the Snow Mountain Power Company. Substations will be located at Fulton and at Sebastopol. John E. Bennett, of Palo Alto; F. C. Wright, of Santa Rosa; M. S. Sayre, of Lakeport, and others are interested in the company.

SUISUN, CAL.—The Great Western Power Company, which has erected a transmission line from the Sierra Nevada Mountains to the bay, is said to be considering the erection of a cable across Carquinez Straits for the purpose of distributing electricity in Solano and Napa counties.

WATSONVILLE, CAL.—Plans have been approved by the Board of City Trustees for the installation of a street-lighting system in Watsonville. The Coast Counties Light & Power Company, it is said, will install about 350 arc lamps of the Mazda type.

WOODLAND, CAL.—Surveys have been completed by the Dozier Engineering & Contracting Company, of Sacramento, for the proposed railway of the Sacramento Valley Westside Electric Company from Woodland to Red Bluff, a distance of about 140 miles. The company has been granted franchises through Yolo and Glenn Counties.

CREEDE, COL.—The Cyrus Miller Leasing Company, of which J. H. Berkshire, of Kansas City, is president, has decided to undertake the sinking of a deep shaft on the old Amethyst property. It is said that the work will include the construction of an electric-power plant, work on which will begin immediately.

DENVER, COL.—Arrangements have been completed by the business men on Larimer Street between Cherry Creek and Seventeenth Street for the installation of an ornamental street-lighting system. The lamps will be suspended from trolley poles by means of ornamental brackets, to which will be suspended arc lamps similar to those on Sixteenth Street.

NEW LONDON, CONN.—Bids will be received at the office of the United States Engineer, New London, Conn., until Dec. 26 for furnishing insulated cable. Further information on application.

NORWICH, CONN.—Preparations are being made by Superintendent W. F. Bogue, of the municipal electric-light plant, to erect a transmission line from the city line in North Washington Street to Norwichtown for the purpose of supplying electricity for lighting that town.

WASHINGTON, D. C.—The American consulate at Quebec has forwarded copies of tenders for electric lighting called for by the city of Quebec. Under the prevailing conditions it will be impossible for American concerns to submit tenders for the lighting system, but the requirement calls for certain lamps and arc lamps, and American firms may desire to correspond with the successful bidder for supplying the lamps, arc lamps and such other devices as may be required to comply with the tender. About 300 ornamental iron or metal posts will also be required. The consul desires catalogues from American manufacturers, giving prices, etc. Copy of complete report and form of tender may be obtained upon application to the Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C. Applicants should refer to No. 7686.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 26 for furnishing the following supplies: At San Juan, P. R., Schedule 4146—two wireless telegraph towers for the naval wireless station. Bids will also be received at the same place until Jan. 2 for furnishing at the various navy yards and stations supplies as follows: Norfolk, Va., Schedule 4147—one set water-tube boilers. Puget Sound, Wash., Schedule 4148—one set water-tube boilers. Brooklyn, N. Y., Schedule 4152—two main feed-water heaters; Schedule 4153—electrical equipment; Schedule

4153—one complete equipment of steam-driven coaling gear machinery. Norfolk, Va., Schedule 4161—eighteen transformers. Boston, Mass., Schedule 4161—5500 lb. condenser tubing; Schedule 4157—17,000 lb. crucible steel wire. Proposals will also be received until Jan. 9, 1912, at the same place for the following: Mare Island, Cal., Schedule 4149—one wireless telegraph set. Philadelphia, Pa., Schedule 4193—24,100 lb. copper tubing, 1600 lb. sheet copper, etc. Applications for proposals should designate the schedule desired by number.

FORT PIERCE, FLA.—At an election held Dec. 12 the proposition to issue bonds to the amount of $90,000 for public improvements, including the installation of an electric-light plant, was carried.

JACKSONVILLE, FLA.—Bids will be received by the Board of Trustees for the Water Works and Improvement Bonds of the City of Jacksonville, Fla., until Jan. 4, 1912, for furnishing complete the following: Electric-conduit work and wiring and fixtures for lighting new power station and certain wiring and fixtures for old power station. Plans and specifications are on file at the office of the board in Jacksonville and at the office of the Scofield Engineering Company, Philadelphia, Pa., copies of which may be obtained upon deposit of $25, which will be refunded on return of same. W. M. Bostwick, Jr., is chairman.

MACON, GA.—Plans are being considered by the City Council for the installation of electrical equipment to operate the water-works pumping station. The Central Georgia Power Company has submitted a proposition to the Council offering to supply electricity to operate the pumps at $45.95 per 5,000,000 gal. per day. Under the present system, which is operated by steam, it costs $50.40 to pump nearly 1,000,000 gal. less. It is understood that the contract with the Central Georgia Power Company will be for a term of twenty years.

BOISE, IDAHO.—Proposals will be received at the office of the United States Reclamation Service, Boise, Idaho, until Jan. 10, 1912, for furnishing four electric derrick hoists and four stiff-leg derricks for the Boise Project, Idaho. For further information address the United States Reclamation Service, Boise, Idaho, or Washington, D. C. F. H. Newell is director.

BOISE, IDAHO.—Final surveys are being made by James A. Green & Company, 226 South La Salle Street, Chicago, Ill., and 509 Overland Building, Boise, Idaho, for the electric pumping plants and irrigation project in the vicinity of Snake River, Malheur County, Ore. The company, it is reported, is in the market for pumping machinery, etc., to be used in connection with this work.

TWIN FALLS, IDAHO.—The Twin Falls, Artesian City & Oakley Interurban Railway Company, recently incorporated with a capital stock of $500,000, is planning to build an electric railway from Twin Falls to Oakley, by the way of Artesian City. The company, it is said, contemplates the construction of an electric-power plant. H. T. West is president of the company.

CHICAGO, ILL.—Sealed proposals will be received by the Board of Directors of the Municipal Tuberculosis Sanitarium of the city of Chicago, 105 West Monroe Street, Chicago, Ill., until Jan. 5, 1912, for the erection of the dining hall and service building, including electric wiring, steam heating, etc., for the Municipal Tuberculosis Sanitarium of the city of Chicago, located at North Fortieth and Bryn Mawr Avenues, Chicago; also for work in connection with the power house of the said institution, which is being readvertised, as follows: Heating and power-plant apparatus, marble and tile work, electric wiring and transformer station, electric generator, engine to drive generators; also for outside sewer system, according to plans and specifications which are on file and may be obtained at the above office. Frank E. Wing is general superintendent.

FOREST PARK, ILL.—Sealed proposals will be received by the Board of Village Trustees of Forest Park, Ill., until Jan. 2, for the sale of the following machinery now in use at the village water and light plant: One Erie City, four-valve, 21-in. x 21-in. engine, rated at 420 hp at 185 r.p.m. with 125 lb. steam, equipped with a 9-ft. x 26-in. face cast-iron pulley, and one 24-in. endless dynamo belt 51 ft. long; also one 180-kw, single-phase Warren induction generator, 800 r.p.m., with 5-kw, 120-volt exciter and belt, and 23-in. x 24-in. face pulley and one white marble switchboard panel complete.

HENRY, ILL.—The Turner-Hudnut Company, which operates a chain of elevators along the Illinois River, has entered into a contract with the Public Service Company of Northern Illinois to supply electricity to operate its elevators at Hennepin, Henry, Lacon and Chillicothe. The Public Service Company contemplates extending its transmission line from Streator to Hennepin.

HILLSBORO, ILL.—Eleven farmers living northeast of Butler have organized an "electric syndicate" and have made arrangements with the Hillsboro Electric Light & Power Company to extend its transmission line into that section. Electricity will be used for motors as well as lamps.

LITCHFIELD, ILL.—M. Bishop has submitted a bid to the City Council for lighting the streets of the city. He offers to furnish eighty-five lamps on a moonlight schedule for $70 per lamp per year for a period of five years. A proposition has been submitted by Harry Tinkelpaugh offering to supply eighty-five lamps on a moonlight schedule at $75 each per year and on an all-night schedule for $90 per lamp per year for a period of five years.

MOKENA, ILL.—A movement is on foot to organize a stock company for the purpose of installing and operating an electric-light plant in Mokena.

PEORIA, ILL.—The Board of County Supervisors is contemplating remodeling the Peoria County court house and the installation of new electrical equipment.

CONNERSVILLE, IND.—The Commissioners of Fayette County have granted the Hydro-Electric Light & Power Company permission to erect transmission lines along the highways in the county. The company, it is said, proposes to extend its system to every part of the county.

FAIRMOUNT, IND.—Application has been made to the Town Board by the Indiana Union Traction Company, of Anderson, Ind., for a franchise to supply electricity for lamps in Fairmount. The company submitted a proposition for furnishing street lamps.

GOSHEN, IND.—H. E. Bucklin, owner of the St. Joseph Valley Traction Company, is planning to build three dams on the St. Joseph River to furnish power for his electric railway, now operated by gasoline motors. Work has already commenced on the first one. Power obtained by means of the first dam will be utilized to operate pile-drivers and machinery used on the second and third dams. The power plant will be erected near the third dam to be located near Pigeon Creek, which will supply energy to operate the railway system.

NOBLESVILLE, IND.—A company has been formed under the name of the White River Corporation to take over and complete a dam in White River for power and storage purposes. The company will also build a power plant to generate electricity for lamps and motors. The company is capitalized at $60,000 and the directors are: Alexander R. Holliday, John H. Holliday, Thomas C. McReynolds and others. One-half of the stock is owned by the Indianapolis Water Company and the other half by the Noblesville Heat, Light & Power Company.

OTTERBEIN, IND.—The County Commissioners have granted the Otterbein Light & Power Company, recently organized, a franchise to erect a transmission line from Lafayette, Ind., to Otterbein. The company will secure energy of the Indiana Lighting Company, of Lafayette, to operate its system in this town. Henry Blot is president of the Otterbein Light & Power Company.

ALLISON, IA.—At an election held recently the proposition to grant a franchise to Claude E. Mackey to erect and operate an electric-light plant in Allison was carried.

DUBUQUE, IA.—Sealed proposals will be received at the office of the Board of Trustees, Dubuque, Ia., until Jan. 22, 1912, for furnishing and erecting a 2,000,000-gal. duplex, double-acting, motor-driven pump at the level pumping station. Copies of proposal, contract and specifications may be obtained at the office of the city water-works. B. F. Stedman is superintendent and R. P. Melendy, engineer.

KEOKUK, IA.—The Keokuk Electric Company, recently incorporated, has taken over the property and holdings of the Keokuk Gas & Electric Company, the Keokuk Electric Railway & Power Company, the Hamilton Light & Power Company and the Western Illinois Electric Company, the last-named company controlling the interurban trolley line from Keokuk to Hamilton and Warsaw. The new company is capitalized at $650,000 and is controlled by the Stone & Webster Corporation, of Boston, Mass. It is understood that A. D. Ayres will be retained as manager.

MAQUOKETA, IA.—Application has been made to the City Council by J. Frank Barnes, of the Barnes Electric Light & Power Company, for a franchise to build and operate an electric-light plant. It is proposed to use crude-oil-burning engines to drive the plant. The plant of the Maquoketa Electric Light Company was formerly operated by water-power, but since the dam was washed away several months ago it has been trying to operate its plant by steam-power. The service has not been satisfactory. If granted a franchise, Mr. Barnes promises to improve the service.

STRATFORD, IA.—The installation of an electric-light plant in Stratford is reported to be under consideration.

ATCHISON, KAN.—The installation of a municipal electric-light plant is under consideration by the City Council. The Council has demanded a material reduction in the present rates for electrical service furnished by the Atchison Railway, Light & Power Company, and unless granted will probably take steps toward the construction of a municipal plant.

HILLSBORO, KAN.—Plans are being considered for the installation of an electric-light system in Hillsboro. It is proposed to secure energy from the municipal electric plant at McPherson. The cost of the transmission line is estimated at about $14,000. Under the present plan it is proposed that the towns of Hillsboro, Lehigh, Canton and Galva unite in the project to secure electricity from the McPherson plant.

MANHATTAN, KAN.—Contracts will be placed by the Manhattan City & Interurban Railway Company for the construction of a new power house. The company expects to purchase an oil or steam engine, two or three large boilers, a 200-kw direct-current belted or direct-connected generator and a 75-kw 125-volt direct-current belted generator.

PERRY, KAN.—At an election held Dec. 9 the proposition to issue bonds to the amount of $5,000, the proceeds to be used for the installation of a municipal electric-light plant, was carried.

ISLAND, KY.—The installation of an electric street-lighting system is reported to be under consideration. Electricity for operating the system may be secured from the plant of the Memphis Mining Company, located about a half mile from the town.

MITCHELLVILLE, LA.—At an election to be held Jan. 9, 1912, the proposition to grant a franchise to George T. Gibson to install an electric-light plant will be submitted to a vote.

ATHOL, MASS.—Extensive improvements and extensions are being made by the Athol Gas & Electric Company to its power plants in Athol and Wendell, which will involve an expenditure of about $30,000. The additions to the plant at Wendell, which will cost about $20,000, have been made necessary to meet the increasing demand for electrical service in Athol and Orange and also the street-railway system of the Athol & Orange Street Railway Company. New equipment is being installed at the Wendell station, including a 500-kw Curtis steam turbine, a 450-hp Sterling boiler, the construction of a concrete boiler house and a concrete smokestack. Provision has been made in the plant for the installation of two more waterwheels with a large generator and two large rotary converters in case they should be needed when the new railway between Orange and Millers Falls is completed. The present improvements will increase the output of the plant to 1500 kw. The improvements to the plant in Athol include the installation of a 425-hp engine to replace an engine of 225 hp and of a 425-kw converter to replace a 225-kw machine.

CAMBRIDGE, MASS.—Plans are being considered for the installation of ornamental street lamps on Massachusetts Avenue between Lafayette Square and City Hall. It is proposed to erect thirty-six posts carrying two lamps each. It is estimated that the new system will cost the city $82.44 per post yer year, making the annual cost $2,967.

SEEKONK, MASS.—The Gas and Electric Light Commissioners have approved the issue of new capital stock by the Seekonk Electric Company to the amount of $5,000, the proceeds to be used to purchase the transmission lines of the Narrangansett Electric Lighting Company, of Providence, R. I., within the town. The Seekonk company proposes to purchase energy from the Narragansett company and to distribute same in the villages of Seekonk and Swansea. The value of the existing lines is estimated at about $1,000, and extensions will be made involving an expenditure of about $5,400.

ANN ARBOR, MICH.—It is reported that all bids for the proposed power house have been rejected by the Board of Regents, plans for which were prepared by Smith, Hinchman & Grylls, engineers, Washington Arcade Building, Detroit, Mich.

CLARA CITY, MICH.—It is reported that a franchise has been granted to Charles Bush and E. Behrends for the installation of an electric-light plant in Clara City, Mich.

GRAND RAPIDS, MICH.—Plans to do away with the West Side power canal are again under consideration. It is proposed to deepen and widen the canal and to erect an electric-power plant between the canal and river, just above the Pearl Street bridge, about opposite the plant of the Powers & Walker Casket Company. It is estimated that about 1000 hp can be developed.

LUDINGTON, MICH.—The Stearns Lighting & Power Company has submitted a proposition to the City Council in connection with a renewal of the street-lighting contract for a term of five years. The company offers to replace the arc-lamp system on East Ludington Avenue with five ornamental lamp standards, each carrying five lamps, which would do away with all electric-light poles in the business center.

ROMEO, MICH.—The Village Council has accepted the proposition of the Eastern Michigan Edison Company to purchase the municipal electric-light plant at $18,000. The proposition will be submitted to a vote at an election to be held Dec. 27. The plant originally cost $35,000 and has been in operation for the past fourteen years. The people demanded a twenty-four-hour service, and it was decided it would be better to sell the plant than to equip it for the additional service.

ALBERT LEA, MINN.—The name of the Albert Lea Light & Power Company has been changed to the Minnesota Gas & Electric Company. The capital stock of the company has also been increased to $750,000. The new company is planning to enlarge its plant and extend its system into the surrounding villages and into the farming districts to supply electricity for lamps and motors. It is understood that the company proposes to remove its power plant to the outskirts of the city, where a larger plant will be erected. Ludwig Kemper is secretary and treasurer.

FEDERAL DAM, MINN.—The Council, it is reported, has been petitioned for a franchise to construct and operate an electric-light plant in Federal Dam.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company, it is said, will submit a new proposal to supply electrical energy to operate the municipal filtration plant, giving the city a lower rate. The city agrees to reduce the amount used while the company is carrying its peak load daily. The cost of erecting a transmission line to the plant is estimated at $10,000.

MORRISTOWN, MINN.—The Consumers' Power Company is reported to have been granted a franchise to supply electricity for lamps and motors in Morristown.

ROCHESTER, MINN.—H. M. Byllesby & Company, of Chicago, Ill., are reported to have submitted a proposition to the City Council for a franchise to supply electrical energy to operate the municipal electric-light plant.

GULFPORT, MISS.—The Gulfport & Mississippi Coast Traction Company is planning to purchase a 2500-kva turbo-generator set for its power house in Gulfport in the near future.

KOSCIUSKO, MISS.—The Planters' Oil & Gin Company, of Kosciusko, Miss., it is reported, is in the market for a 75-kw to 100-kw, 1100-volt, 125-cycle, single-phase, second-hand generating unit.

MOKANE, MO.—C. E. Moseley is reported to be interested in the establishment of an electric-light plant in Mokane.

TWIN BRIDGES, MONT.—The Madison River Power Company has completed all arrangements for lighting the streets of the town. Owing to the Town Council being unable to come to an agreement upon the street-lighting question the streets are still in darkness.

KEARNEY, NEB.—Plans are being prepared by the Oscar Claussen Engineering Company, of St. Paul, Minn., for the installation of a municipal electric-light plant in Kearney. It is proposed to operate this plant in connection with the water-works system. The plans include the installation of an ornamental street-lighting system in the business district. It is said that oil engine, gas producer and steam-power equipment will be considered. J. F. Druar, engineer, is in charge of the work.

OSMOND, NEB.—The Village Board has granted a franchise to B. S. Leedon & Son to install an electric-light plant in Osmond. It is understood that the plant will be installed by the Alamo Engine & Supply Company, of Omaha, Neb.

GOLDFIELD, NEV.—Plans are being considered by the Goldfield Deep Mines Company, recently incorporated, for the installation of a 250-hp electric hoist and air-compressor plant. Senator W. A. Clark and others are interested in the company.

WASHOE, NEV.—The Commonwealth mine is remodeling its hydro-electric power plant. New equipment will be installed. C. N. Miller is general manager of the company.

HOBOKEN, N. J.—Plans are being considered by Wilson Taylor, president of the Hoboken Board of Education, to establish a power plant to supply electricity for lamps and motors for all the schools throughout the city. The cost of the proposed plant is estimated at about $25,000. Mr. Taylor places the annual saving at $6,000 per year.

BROOKLYN, N. Y.—Bids will be received by the commissioner of water supply, gas and electricity, Department of Water Supply, Gas and Electricity, Room 1904, 13 to 21 Park Row, New York, until Dec. 29 for furnishing, installing, maintaining and reserving for use of the high-pressure fire service all apparatus and equipment necessary for generating and transmitting 1830 kw of three-phase, 6600-volt, 25-cycle power and furnishing and delivering this power under the terms of this contract from Jan. 1, 1912, to Dec. 31, 1912, both inclusive, at each of the high-pressure fire-service pumping stations located in the borough of Brooklyn, at Furman and Joralemon Streets and at Willoughby and St. Edward's Streets respectively. Blank forms may be obtained at the office of the department, Room 2339 Park Row Building, New York, N. Y. Henry S. Thompson is commissioner.

CATSKILL, N. Y.—Application has been made to the Public Service Commission, Second District, by the Schoharie Light & Power Company, the Catskill Illuminating & Power Company and the Upper Hudson Electric & Railroad Company for approval of consolidation of these companies and for authority to issue capital stock and bonds.

JAMAICA, N. Y.—Sealed proposals will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until Jan. 2, for installing electric equipment in the new Public School 40, located at the corner of Pacific and Union Hall Streets, Jamaica, borough of Queens. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, Hall of Board of Education, Park Avenue and Fifty-ninth Street, New York, and also at branch office, 69 Broadway, Flushing, borough of Queens.

JAMESTOWN, N. Y.—The Public Service Commission, Second District, has granted the Jamestown Lighting & Power Company permission to exercise rights and privileges conferred upon it under a franchise granted by the Town Board of Ellicott for furnishing electricity for lamps and motors in that town.

NEWFANE, N. Y.—The Newfane Electric Company has received authority from the Public Service Commission, Second District, to issue additional capital stock to the amount of $7,000, the proceeds to be used for payment of expenditures incurred for proper capital expenses.

NEW YORK, N. Y.—Bids will be received by the commissioner of bridges, Department of Bridges, 13 to 21 Park Row, New York, N. Y., until Dec. 28, for furnishing and installing electrical feeder cables on the westerly track of the upper deck of the Manhattan Bridge. Blank forms and specifications may be obtained at the above office. Arthur J. O'Keefe is commissioner.

NEW YORK, N. Y.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 13, 1912, for furnishing three 200-kw motor-generator sets and controlling panels at the navy yard, New York, N. Y. Specifications can be obtained on application to the bureau or the commandant of the navy yard named. The cost of the work is estimated at $16,000. R. C. Hollyday is chief of bureau.

NEW YORK, N. Y.—Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 13, 1912, for extension of underground compressed-air mains at the navy yard, New York, N. Y., plans and specifications for which may be obtained on application to the above bureau or to the commandant of the navy yard named. The cost of the work is estimated at $8,500. William M. Smith is acting chief of bureau.

NEW YORK, N. Y.—Proposals will be received by the president of the Board of Trustees of Bellevue and Allied Hospitals, New York, N. Y.,

until Dec. 28 for furnishing all labor and materials required for the reconstruction of the electric-light system at the main building and overhauling of same at the ambulance building, power house and laundry building of the Harlem Hospital, situated at 136th to 137th Street and Lenox Avenue, New York, N. Y. Blank forms may be obtained at the office of the contract clerk, 400 East Twenty-ninth Street, New York, N. Y. John, W. Brannan is president of board of trustees.

NEW YORK, N. Y.—Bids will be received by the commissioner of water supply, gas and electricity, Department of Water Supply, Gas and Electricity, Room 1904, 13 to 21 Park Row, New York, N. Y., until Dec. 29 for furnishing, maintaining, installing and reserving for the use of the high-pressure fire service all apparatus and equipment necessary for generating and transmitting 3250 kw of three-phase, 6600-volt, 25-cycle electric power and furnishing and delivering this power under terms of this contract from Jan. 1, 1912, to Dec. 31, 1912, both inclusive, at each of the high-pressure fire-service pumping stations located in the borough of Manhattan, at Oliver and South Streets and at Gansevoort and West Streets respectively. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building, New York, N. Y. Henry S. Thompson is commissioner.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities until Jan. 2 (extension of date from Dec. 21) as follows: (1) For furnishing materials and labor for underground-conduit system, transformer vault, electric elevator and other work in the metropolitan hospital district; (2) for complete electric wiring and fixtures for infirmary dining-room and kitchen, female tuberculosis building and sun tests, solarium pavilions Nos. 1 to 5, superintendent's residence, carpenter shop, coffin shop, stable, power house and laundry building for metropolitan hospital district; (3) for complete electric wiring and fixtures for new Roman Catholic church, male infirmary and sun tents, and electric motors for laundry for metropolitan hospital district; (4) for furnishing labor for ground wire and labor and materials for grounding system, lightning arresters and automatic switches for metropolitan hospital district. Blank forms and further information may be obtained at the office of Frank Sutton, consulting engineer, 80 Broadway, New York, N. Y., where plans and specifications may be seen. Michael J. Rrummond is commissioner.

SODUS, N. Y.—The Town Board has granted a franchise to Omar Curtis, representing the Northern Wayne Electric Light Company, to install an electric light and power system in the town of Sodus, east of the substation. The company also contemplates erecting electric systems in Rose, North Rose, Wolcott and possibly Red Creek, to supply electrical service in those places. The franchise granted by the Town Board of Sodus will enable the company to furnish electricity in the villages of Sodus Point and Sodus Center, in addition to Wallington and Alton.

ALBEMARLE, N. C.—Proposals will be received by the Mayor and the Board of Commissioners of the town of Albemarle, N. C., until Jan. 16 for the construction of a water-works system, which will include the erection of a pumping station, clear-water basin, deep well, two motor-driven turbine pumps having a capacity of 750 gal. per minute each, switchboard and 1 mile of pole line, tower and tank and about 5 miles of 6-in. to 10-in. pipe line. Plans and specifications are on file at the office of the Mayor in Albemarle and at the office of Gilbert C. White, engineer, Charlotte, N. C. Copies of specifications, proposal blanks, etc., may be obtained on application to the engineer. A complete set of blueprints will be furnished on payment of $3 to cover cost of same. M. J. Harris is Mayor.

MAIDEN, N. C.—The Council is reported to be considering the installation of an electric-lighting system in Maiden. It is proposed to obtain electricity from the substation of the Southern Power Company at Charlotte, N. C., to operate the system.

WENTWORTH, N. C.—Bids will be received by the County Commissioners of Rockingham County, North Carolina, for furnishing a modern lighting plant for the court house and jail. For further information address J. P. McMichael, clerk of County Commissioners, Wentworth, N. C.

MILTON, N. D.—The installation of an electric street-lighting system in Milton is reported to be under consideration.

ALLIANCE, OHIO.—It is said that Mayor Speidel in his annual message will recommend to the new Council that initial steps be taken toward the installation of a municipal electric-light plant in order to have the plant ready for operation by the time the franchise of the Alliance Gas & Power Company expires.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company submitted the only bid for lighting the streets of the city. The company offered to supply arc lamps at $51.56 each per year, which is a reduction of $1.92 per lamp paid under the present contract.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company has applied to the Ohio Public Service Commission for permission to issue common stock to the amount of $1,500,000, to be sold at par, and to issue $1,500,000 in first-mortgage bonds, to be disposed of for cash and at par. The proceeds are to be used to provide for improvements, betterments, etc., and to liquidate certain existing indebtedness.

COLUMBUS, OHIO.—The report of the special committee appointed by the Council to determine the number of new street lamps required has been accepted by the Council with a recommendation that it be turned over to the new director of public service after the first of the year. The committee recommends the installation of 214 additional lamps.

GREENVILLE, OHIO.—Sealed proposals will be received by the director of public service, Greenville, Ohio, until Dec. 30 for furnishing electric street lamps and gas lamps for alleys and public places for a term of years beginning Jan. 1, 1912, and ending June 17, 1920. D. W. Shively is director of public service.

NILES, OHIO.—Plans are being considered by the City Council for the installation of an ornamental street-lighting system on the principal streets of the city, bids for which will be called for in the near future.

TROTWOOD, OHIO.—The County Commissioners have granted the Dayton Light & Power Company a second franchise, giving the company permission to extend its transmission line from Fort McKinley to Trotwood for the purpose of supplying electricity for lamps and motors in Trotwood. The company was recently granted a franchise to extend its system to Fort McKinley.

KINGFISHER, OKLA.—The Benham Engineering Company, of Oklahoma City, Okla., is preparing plans and specifications for extensions to the municipal electric-light plant and water-works system in Kingfisher. Bids for material will be received about Jan. 15.

OKLAHOMA CITY, OKLA.—Plans are being considered by the Chamber of Commerce and the Oklahoma City Retailers' Association for the installation of an ornamental street-lighting system in the downtown district of the city.

PONCA CITY, OKLA.—Plans and specifications are being prepared by Burns & McDonnell, of Kansas City, Mo., for the municipal electric-light plant in Ponca City, for which bonds to the amount of $30,000 were recently voted.

WAGONER, OKLA.—Plans and specifications are being prepared by the Benham Engineering Company, of Oklahoma City, Okla., for extensions to the municipal water-works system and electric-light plant at Wagoner, Okla. It is expected that bids will be called for material about Feb. 1, 1912.

LAKEVIEW, ORE.—The proprietors of the Ramona Hot Springs, located near Lakeview, are said to be planning to install an electric-power plant.

LINTON, ORE.—The electric power plant of the Western Oregon Lumber Company was recently destroyed by fire, causing a loss of about $200,000.

PORTLAND, ORE.—The Oregon Electric Railway Company, it is reported, is planning to construct an electric railway from Portland to McMinnville, via Newberg, a distance of about 40 miles, work on which will begin at once. The line will eventually be extended to Dallas, 25 miles distant.

CONNEAUTVILLE, PA.—Plans are being considered for the installation of an electric-light plant in Conneautville. Electricity for operating the system will be secured from the plant at Meadville.

JOHNSTOWN, PA.—The board of directors of the Dale Light, Heat & Power Company has authorized extensive improvements to its plant, which will involve an expenditure of about $12,000. At the annual meeting to be held Jan. 5 the stockholders will be asked to vote on the proposition to increase the capital stock of the company from $30,000 to $250,000. The plant of the company is located in the newly annexed portion of Stonycreek Township. C. F. Lancaster is manager.

MAUCH CHUNK, PA.—Plans have been prepared by the Lehigh Valley Coal & Navigation Company for the construction of a large electric generating plant in its mining region for the purpose of supplying electricity to manufacturing industries in the territory adjacent thereto within a radius of 40 miles and for use on its own mining properties.

MERCER, PA.—The Borough Council has granted the Mercer County Electric Light & Heat Company a franchise to build and operate an electric-light plant in Mercer. Under the terms of the franchise the company is to begin work on the proposed system within thirty days and to have the plant in operation within six months. It also provides that arc lamps are to be furnished for street lighting at $75 each per year up to twenty in number and $65 each per year for all above that number. Electricity for lighting the fire department is to be furnished free of charge. The Mercer County Electric Light & Heat Company has recently acquired the capital stock of the Greenville Electric Light, Heat & Power Company.

PHILADELPHIA, PA.—Sealed proposals will be received by Joseph R. C. McAllister, president Board of Recreation, City Hall, Philadelphia, Pa., until Dec. 26 for furnishing electric arc lamps and incandescent electric lamps for lighting the miscellaneous playgrounds in the city of Philadelphia, Pa. Approximately 100 arc lamps and 700 incandescent lamps will be required.

PITTSBURGH, PA.—The committee on public works of the Council has recommended that the Mayor and director of the Department of Public Works be authorized to advertise for bids for electricity for lighting the streets for a term of one year, and also for furnishing incandescent mantle lamps for the same period.

SHARON, PA.—Plans and estimates have been submitted to the City Council by D. M. Hosford, of Cleveland, engineer, for the proposed municipal electric-light plant. The cost of the plant is estimated at $83,322. Provision is made for 250 6.6-amp magnetite arc lamps for a street-lighting system and for a commercial load sufficient to supply a population of 18,000.

WEATHERLY, PA.—A special election will be called Jan. 8, 1912, to vote on the proposition to issue bonds to the amount of $14,000, the proceeds to be used for the installation of a power plant in connection with the municipal electric-light plant.

TIVERTON, R. I.—The stockholders of the Tiverton Electric Company have voted to increase the capital stock of the company from $12,000 to $36,000, the proceeds to be used for extension of transmission lines and additional equipment to meet the increasing demand for electrical service. The company purchases electrical energy from the Fall River Electric Light Company to operate its system.

MENNO, S. D.—The Town Board has granted a twenty-year franchise for the installation of an electric-light plant. Under the terms of the franchise the system must be completed and in operation not later than July 1, 1912.

WAKONDA, S. D.—The Wakonda Light, Power & Heating Company, recently organized, will apply for a twenty-five-year franchise to install an electric-light and heating plant. The company is capitalized at $10,000.

BRISTOL, TENN.—The City Council is considering a proposition submitted by the Bristol Gas & Electric Company for the erection of fifteen arches, one to be erected over each of the principal streets of the city.

COWAN, TENN.—The installation of an electric-light plant in Cowan is reported to be under consideration.

JOHNSON CITY, TENN.—S. B. Vaught, financial secretary of Emory and Henry College, Johnson City, Tenn., it is reported, would like to receive estimates on cost of electric-light plant for the community.

KNOXVILLE, TENN.—The Aluminum Company of America, of Pittsburgh, Pa., has purchased the right-of-way for a distance of 40 miles along the Tennessee River in Blount County, Tenn., and across the state line in North Carolina. The company proposes to build a large power plant and utilize the water-power to generate electricity to operate a large aluminum plant. It is understood that 200,000 hp will be developed at a cost of $12,000,000. As yet the company has not decided whether to erect its refining plant near the power dams or in Knoxville.

LEXINGTON, TENN.—Bonds to the amount of $50,000 have been sold by the city, the proceeds of which will be used for the installation of an electric-light plant and water-works system in Lexington. R. C. Houston, engineer, of Memphis, Tenn., will have charge of the work.

CALVERT, TEX.—The City Council has granted the Calvert Water, Ice & Electric Light Company a new franchise for a period of fifty years. The company has agreed to make a number of improvements to its light and water systems, which will involve an expenditure of about $14,000.

DALLAS, TEX.—A power plant will be installed in the basement of the twelve-story concrete office building for physicians to be erected by J. Ashford Hughes at Commerce and Pearl Streets. Lang & Witchell are architects.

DECATUR, TEX.—At an election to be held Jan. 2, 1912, the proposition to issue $18,000 in bonds, the proceeds to be used to purchase the water and light plant of the Decatur Water, Light & Power Company, which was recently damaged by fire, will be submitted to a vote. It is proposed to purchase the plant at $10,000 and expend $8,000 for improvements.

DENISON, TEX.—The City Council is considering the question of extending the street-lighting system in all parts of the city.

DONNA, TEX.—It is reported that plans are being considered to establish a combined electric-light plant and cottonseed-oil mill and ice plant. B. H. Hooks is said to be interested in the project.

HUNTSVILLE, TEX.—Bids will be received until Jan. 5 by the Prison Commissioners, J. A. Palmer, secretary, for electrical machinery for shops and power plant at Huntsville. For specifications and further information address Benjamin E. Cabell, chairman.

SEADRIFT, TEX.—The Council is reported to have granted a franchise to G. W. Huff, of Corpus Christi, Tex., to install and operate an electric-light plant in Seadrift.

TIOGA, TEX.—C. B. Glasscock is reported to have been granted a franchise by the Council to construct and operate an electric-light plant in Tioga.

PROVO, UTAH.—The County Commissioners have granted the United States government a twenty-five-year franchise to erect a transmission line from the government power plant in the mouth of the Spanish Fork Canyon to Salem, Payson and Lincoln. Preparations are being made by the government to supply electricity for lamps and motors in the south end of Utah County and also for the farming districts under the Strawberry project.

TREMONTON, UTAH.—Negotiations are under way between the Town Board and the Utah-Nevada Sugar Company whereby the latter will supply electricity for lighting the town of Tremonton. The company offers to deliver power to the city limits if arrangements can be made for the installation of a distributing system.

WINOOSKI, VT.—The Board of Village Trustees has granted the Burlington Light & Power Company permission to replace the present street lamps with luminous arc lamps. There are forty-one lamps to be replaced.

ABERDEEN, WASH.—The Mutual Heat & Light Company, recently incorporated, has been granted a franchise for the installation of a distributing system in Aberdeen, including the erection of overhead lines and a conduit system.

BELLINGHAM, WASH.—The contract for the installation of a lighting and heating system in the federal building in Bellingham has been awarded to Christopher & Blythe, of Bellingham, at about $40,000.

DUVALL, WASH.—Plans are being prepared by Roy W. Comegys, of Duvall, recently granted a franchise for an electric plant and water-works system in Kings County, for the construction of a hydroelectric power plant and transmission system, which, it is said, will involve an expenditure of about $200,000.

LEAVENWORTH, WASH.—It is reported that plans and estimates are being prepared for the Washington Steel & Iron Company, of Spokane, Wash., for the construction of a concrete dam on the Wenatchee River in Leavenworth. A franchise has been granted the company to supply electricity for lamps in Leavenworth. R. J. Zell, of Spokane, is engineer.

NORTH YAKIMA, WASH.—Plans are being considered by the North Yakima & Valley Railway Company, which operates between North Yakima and Naches, a distance of about 12 miles, to equip its railway for electrical operation, at a cost of approximately $350,000. George Donald is president of the company.

REPUBLIC, WASH.—The North Washington Power & Reduction Company has commenced work on the installation of new boilers, generator and other equipment at its property. J. E. McFarland is general manager of the company.

SEATTLE, WASH.—The chief object of the Seattle Northeast Improvement Club, recently organized by the property owners in that portion of the city, is to obtain street lamps for that district of the city. R. W. Douglas is president of the club.

SPOKANE, WASH.—Plans are being prepared by the Spokane & Inland Empire Railroad for the installation of a 500-kw motor-generator set, for which orders will soon be placed.

SUNNYSIDE, WASH.—Work will soon begin on the installation of a street-lighting system in Sunnyside, consisting of magnetite-arc lamps.

WHITE BLUFFS, WASH.—The Pacific Power & Light Company has completed the installation of an electric-light system in White Bluffs. The company has been granted a fifty-year franchise in Benton County and proposes to erect transmission lines to all sections of the valley to supply electricity for pumping and irrigating work.

MATEWAN, W. VA.—It is reported that G. T. Blankenship is preparing plans for the installation of an electric-light plant in Matewan. It is understood that material for the proposed plant has been purchased.

MILLVILLE, W. VA.—It is reported that plans are being made for the erection of a high-tension transmission line from the electric plant of the Winchester & Washington City Railway Company at Millville, W. Va., to Brunswick, Md. For further information address D. M. Swink, of Millville, W. Va., general manager.

JUNEAU, WIS.—The Theresa mill in Juneau has been purchased by Nathan Haessby. Extensive improvements will be made to the mill. It is understood that an electric-light system for the village will be installed as soon as the weather permits.

MILWAUKEE, WIS.—The Common Council has directed the Commissioner of Public Works to advertise for bids on machinery for the proposed municipal electric-light plant.

WAUWATOSA, WIS.—The Board of Supervisors of Milwaukee County is reported to have prepared tentative plans for a central heating plant and power station for the group of county buildings at Wauwatosa, to replace the present individual systems. The plans involve an expenditure of approximately $75,000. Martin Blehn is county clerk.

VANCOUVER, B. C., CAN.—The City Council is considering plans for the installation of ornamental street lamps on about 20 miles of prominent thoroughfares. City Electrician Hughes is in charge of the improvement.

WINNIPEG, MAN., CAN.—Sealed tenders will be received by the chairman of the Board of Control, Winnipeg, Man., until Dec. 29 for furnishing and installing complete a vertical centrifugal pump driven by an induction motor, direct-connected, the pump to be capable of pumping 1,000,000 gal. per twenty-four hours. Instructions to bidders, specifications and form of tender may be had at the office of the city engineer.

BRIDGEBURG, ONT., CAN.—The Village Council is negotiating with the Canadian Niagara Power Company, of Niagara Falls, Ont., for the installation of an electric-lighting system in Bridgeburg.

PARIS, ONT., CAN.—An estimate of the cost of installing a system to utilize electricity to be furnished by the Hydroelectric Power Commission in Paris has been submitted by Harry Acres, government engineer, to the Board of Trade. The cost is estimated at $13,000. It is expected that a by-law will be submitted to the ratepayers in the near future.

TORONTO, ONT., CAN.—On New Year's Day at least twenty-eight municipalities will vote on the proposition as to whether they will enter into agreement with the Hydroelectric Power Commission for electrical energy. It is proposed to develop water-power on the Maitland and Saugeen Rivers, where it is estimated that 15,000 hp is available. As these rivers are practically dry during the summer months, the systems will be augmented by a loop attached to the Niagara system, so that power will be available at all times of the year. New transformer stations will be erected at Guelph and Seaforth in order to augment the supply from the Maitland and Saugeen Rivers. If the western lines are erected, one will extend from Seaforth to Goderich, Clinton, Bayfield, Hensall, Exeter, Zurich, Dashwood, Crediton, Leith, Brussels, Wingham

and Belgrave. The other will run from Guelph to Elora, Fergus, Arthur, Mount Forest, Harriston, Palmerston, Listowel, Durham, Shallow Lake, Owen Sound, Meadford, Thornbury, Wiarton and Collingwood. From these two trunk lines branch lines will run to every town and village in the district. In the Trent Canal district all towns from Whitby to Cornwall will be served. More than 4000 hp will be developed on the Trent Valley Canal, and on the Ottawa River at Chat's Falls there is a possible development of 100,000 hp. The cost of the proposed system is estimated at $5,000,000.

BUCKINGHAM, QUE., CAN.—The town of Mont Laurier, located on the Du Lievre River, about 100 miles above Buckingham, is installing a water-works system, to cost about $35,000. An electric-light and power plant will be installed in the near future.

MONTREAL, QUE., CAN.—The power station of the Saraguay Electric & Water Company, at Cartierville, was destroyed by fire recently.

MONTREAL, QUE., CAN.—A meeting of the stockholders of the Shawinigan Water & Power Company will be held Dec. 27 to ratify an issue of $500,000 in debentures, making the total $4,500,000.

MONTREAL, QUE., CAN.—The Citizens' Committee of Greenfield Park has petitioned the Town Council to enter into negotiations with the Montreal Light, Heat & Power Company in order to induce the company to extend its service to this town. The Council is also asked to secure an extension of the Southern Counties Railway Company's street-car system to Greenfield Park next year.

PARRAL, MEX.—The Parral Power & Reduction Company has sold its electric-power plant, located near Parral, to the Alvarado Mining & Milling Company. Extensions and improvements will be made to the plant.

PARRAL, CHIHUAHUA, MEX.—Plans are being considered for the installation of a gas-producer plant at the Capitanena mine, in the San Francisco del Oro district. D. H. Bradley, Jr., is manager of the property.

PUENTE GRANDE, JALISCO, MEX.—The Chapala Hydro-Electric Company is planning to install a new insulating system on its transmission lines in the Hostotipaquillo and Etzatlan mining districts.

New Industrial Companies.

THE AMERICAN ELECTRIC COMPANY, of Indianapolis, Ind., has been incorporated with a capital stock of $10,000 by R. A. Love, P. G. Winter and Robert Steven.

THE BATTERY ELECTRIC COMPANY, of Indianapolis, Ind., has been incorporated by William J. Rabert, S. and D. A. Battley. The company proposes to deal in electrical material and devices of all kinds, install and equip electric plants, telephone lines, electric railways and all kinds of electrical construction work.

THE BROOKS CONSTRUCTION COMPANY, of Fort Wayne, Ind., has been chartered with a capital stock of $25,000 for the purpose of building electric and steam railroads and general construction work. John F. Brooks, L. E. Ginn and C. J. McGee are directors.

THE CHICAGO RAILWAY SIGNAL & SUPPLY COMPANY, of Carpentersville, Ill., has been chartered with a capital stock of $10,000 by John F. Fierke, H. Howard C. McNeil and Charles E. Griffith. The company proposes to manufacture and deal in railway signals, apparatus, etc.

New Incorporations.

OAKLAND, CAL.—Articles of incorporation have been filed for the Merced River Power Company, with a capital stock of $10,000,000, by Leon M. Gave, H. L. Breed, Charles Gross, J. E. Bowes and Milton S. Hamilton.

SAN FRANCISCO, CAL.—The Feather River Power & Irrigation Company has been incorporated with a capital stock of $10,000,000 by R. K. Barrows, of Lakespur; A. N. Lewis, Jr., of Alameda; A. L. Dohlf, of San Francisco, and F. C. Devine, of Berkeley. The company proposes to develop a water-power on the Feather River Canyon along the line of the Western Pacific Railway.

YOLO, CAL.—The Yolo Water & Power Company has filed articles of incorporation with a capital stock of $10,000,000 for the purpose of building power plants, impounding water and developing electricity in the Sierras.

SPRING VALLEY, ILL.—Articles of incorporation have been filed for the Spring Valley Gas & Electric Company by C. H. Brown, Harry E. Brown and Roy W. Brown. The company is capitalized at $30,000 and proposes to generate and distribute gas and electricity.

ANGOLA, IND.—The Angola Light & Power Company has been chartered with a capital stock of $50,000 by D. M. Vesey, A. J. Vesey and W. E. Mossman. The company, it is said, will take over and operate the plant of the Angola Railway & Light Company.

HOLLAND, IND.—Articles of incorporation have been filed for the Home Electric Light Company with a capital stock of $15,000 by J. H. Heitman, J. H. Miller, H. W. A. Hemmer and J. F. Overbeck. The company proposes to install a power plant to supply electricity for lamps and motors in the town of Holland and in Dubois County.

Personal.

MR. R. T. DEMAREE, manager for the Pacific Telephone & Telegraph Company at Dinuba, Cal., has resigned.

MR. E. H. FRANK, manager of the supply department of the Guarantee Electric Company, Chicago, has resigned to engage in other business.

MR. EDWARD WRAY has been appointed secretary of the Chicago Section of the Illuminating Engineering Society, succeeding Mr. A. L. Eustice, resigned.

MR. FRED L. JOHNSON, formerly city engineer, Santa Barbara, Cal., has been appointed supervising engineer of the Southern Sierras Power Company at San Bernardino, Cal.

MR. ROSSITER HOLBROOK, of New York, read a paper entitled "The Gas Engine and the Central Station" at the annual convention of the National Gas Engine Association held in Cleveland on Dec. 4 and 5.

MR. THEODORE N. VAIL, president of the American Telephone & Telegraph Company and the Western Union Telegraph Company, has been making an extended inspection tour in the West. He is reported to have said that telephone communication between New York and San Francisco will be made within a year.

MR. EDWIN R. ROCKWELL, president of the Guarantee Electric Company, of Chicago, has resigned from the company, both as director and president, his resignation taking effect Jan. 1. Mr. Rockwell retains his financial interest in the company, with which he has been connected for the last nine years, first as secretary and treasurer and for the last six years as president. His plans for the future are undetermined.

BRIG.-GEN. GEORGE H. HARRIES, recently elected president of the Louisville Lighting Company, of Louisville, Ky., furnished an interview last week which was the basis of a full-page feature story in the magazine section of the *Louisville Herald* on Sunday. A half-page drawing by the newspaper's artist set off the article, it representing General Harries, in full-dress uniform, touching off an old-time cannon which directed a fusillade of electric-light bulbs into space.

MR. A. T. MACDONALD, general sales manager of the Louisville Lighting Company, who is prominent in the affairs of the Kosair Temple of the Mystic Shrine of that city, has been elected delegate of the Gateway City Shrine to the 1912 convention of the national organization, which will be held in Los Angeles, Cal., next May. Mr. Macdonald is an active worker toward the establishment of a magnificent temple in the Falls City, such as that which now graces Indianapolis, Ind.

PROF. WILLIAM C. BAUER, professor of electrical engineering in Northwestern University, Evanston, Ill., has been appointed acting director of the College of Engineering during the absence of Professor J. F. Hayford, who has been appointed a member of an international commission of engineers to report on the disputed boundary line between Costa Rica and Panama. The American members of the commission will leave for Central America in January to take advantage of the dry season.

MR. WILLIAM H. THOMSON, JR., operating engineer with the Illinois Traction System, has been appointed general manager of the Des Moines Electric Company to succeed Mr. P. B. Sawyer, who will become general manager of the Union Electric Company, Dubuque, Ia. Mr. Thomson was graduated from Cornell University in 1898. For four years after leaving Cornell he was assistant to the general manager and engineer of the St. Paul Gas Light Company. He then held the position of general manager of the Union Light, Heat & Power Company, of Fargo, N. D., and was promoted from that position to be assistant general manager of the San Antonio Gas, Electric & Traction Company, of San Antonio, Tex. Mr. Thomson has also acted as general manager of the Corsicana Gas, Electric & Traction Company, of Corsicana, Tex., and for the last year has been occupying the position of operating engineer of the Illinois Traction System.

MR. B. A. BEHREND has been awarded the John Scott Medal by the Franklin Institute for his contribution to the advancement of the electrical industry. This award recognizes the prominent part which the work of Mr. Behrend has played in the development of alternating-current machinery in this country, both from the manufacturer's and the user's point of view. In introducing high peripheral speeds for water-wheel alternators, and in insisting upon the proper voltage margin of generators for low-power-factor loads, rather than extremely close regulation under hypothetical conditions; upon proper kva to kw proportioning of prime mover and generator, and upon cool operation under actual, rather than hypothetical, operating conditions, he became conspicuous thirteen years ago by adopting an attitude which now appears commonplace. In embarking upon turbo-generator construction in 1902, after careful deliberation, Mr. Behrend determined upon, and developed in this country, a general type which, while then in use only sparingly in Europe, and not at all here, has since been adopted almost universally in Europe and shows signs of similarly taking the field here. In regard to the theory of the practical and commercial design of induction motors, it is only necessary to recall the important work done by Mr. Behrend in Europe at a time when the few manufacturers of this apparatus were groping in the dark.

Obituary.

J. C. FULLER.—The death is announced of Mr. John Crisp Fuller, of Ham Lodge, Stratford, and Woodland Works, Bow, England, aged ninety. Mr. Fuller was the inventor of the Fuller bichromate battery. He was born in Bristol in 1821, but went to London when he was quite young. He became fascinated with the study of electricity, and about 1854 he became connected with the Electrical & International Telegraph Company, with which he continued for a number of years. Later he assisted Mr. W. T. Henley, the submarine-cable manufacturer, and thereafter he founded his own firm, John C. Fuller & Son.

MR. C. C. COKEFAIR, president and general manager of the Great Northern Development Company, died at Duluth, Minn., on Dec. 13, after an illness of about two weeks, of pneumonia. Mr. Cokefair was born in Bloomfield, N. J., sixty-three years ago, and went to Duluth in 1899. He was the originator and promoter of the Great Northern Power Company, and after the completion of that enterprise became interested in other water-power projects in the Northwest, principally on the Mississippi River. He recently began grading work on Mississippi River frontage owned by him at Coon Creek, 12 miles from Minneapolis. He announced that he would build a dam at Coon Creek and later one at Anoka and would furnish the Twin Cities with electric energy. He was one of the men behind the Mississippi River Improvement Company and the Minnesota Power and Trolley Company.

MR. DANIEL C. HEMINGRAY, secretary and treasurer of the Hemingray Glass Company, of Covington, Ky., and Muncie, Ind., died at the Queen City Club, Cincinnati, Ohio, on Dec. 14, from apoplexy. The preceding Tuesday Mr. Hemingray was taken ill in an automobile after leaving his office in Covington, Ky., and was taken to the Queen City Club. The following day his condition appeared to improve, but during the night he suffered a relapse and he died at 5 o'clock on Thursday morning. Mr. Hemingray, who was fifty-four years old, was born in Covington, Ky. He attended the Woodward High School in Cincinnati, where he was a classmate of President Taft, and later entered the Massachusetts Institute of Technology. Before graduation he returned to Covington and entered business with his father and brother, Mr. Ralph Hemingray, now president of the Hemingray Company. Mr. Hemingray was a member of the principal Cincinnati clubs and a non-resident member of many clubs throughout the country, much of his time being passed in traveling in connection with his business. He was a director of the Cincinnati Trust Company and of the Suspension Bridge Company and one of the first stockholders of the Latonia Racing Association. At one time he was a member of the Covington Water Works Department. Mr. Hemingray was extremely popular in Cincinnati and had large circles of friends in different sections of the United States. His jovial disposition and hale good-fellowship were particularly appreciated in his club life. As remarked by a friend, "There were no dull moments in his company, and many are the Queen City club members who, oppressed by the cares of business, found momentary rest from their worries in the optimistic, jovial and happy temperament of 'Dan' Hemingray."

DANIEL C. HEMINGRAY.

MR. E. C. NORTON, of Escanaba, Mich., vice-president and general manager of the Norton Logging Company and vice-president of the Northwestern Cedarmen's Association, died at his home in Escanaba on Dec. 9. Mr. Norton, who was but thirty-six years of age, was a native of Burlington, Wis. He went to Escanaba thirteen years ago as cedar-pole inspector for the Kinloch Telephone Company, of St. Louis. He afterward organized an inspection bureau for a number of telephone companies and later was placed in charge of the pole department of the Kellogg Switchboard & Supply Company, of Chicago, with headquarters at Escanaba. He continued in the last-named capacity until three years ago, when he bought out the Kellogg company's pole business and conducted a pole and post business under his own name. He also organized the Norton Logging Company. He was elected vice-president of the Northwestern Cedarmen's Association at the convention of last January. He was also prominent in the Masonic order, being a Knight Templar and a Shriner. His death was the result of an illness of two weeks and followed an operation for peritonitis undertaken as a last resort. Mr. Norton is survived by a widow and two daughters. He was a man of high character who was admired and respected by his friends and acquaintances. At a meeting of the board of directors of the Northwestern Cedarmen's Association held in Minneapolis on Dec. 9 appropriate resolutions on the death of Mr. Norton were adopted and spread upon the records of the association.

Trade Publications.

RIGID CONDUIT INSTALLATION.—The National Metal Molding Company, Pittsburgh, Pa., has issued a folder to the trade illustrating various buildings throughout the country in which the wiring is installed in "Sherarduct" conduit. The latter is made of annealed iron zinc treated and galvanically protected on the inside as well as the outside against corrosion.

PLASTIC INSULATING COMPOUND.—Condensite, a phenolic condensation product, adapted for use as an impregnating substance for electrical apparatus, wood and other fibrous or cellular matter and which can also be employed for molding, is described in a pamphlet published by the Condensite Company of America, Glen Ridge, N. J. Tests showing its dielectric and mechanical strength are given, as well as illustrations of some of the molded products made from the material.

ELECTROPLATING DYNAMOS.—Bulletin No. 100 issued by the Munning-Loeb Company, Matawan, N. J., describes the company's "Optimus" electroplating dynamos. Two and three-wire units in both belt and direct-connected types are illustrated and test curves showing the performance of each are included. The machines are compounded to give uniform voltage from no load to overload and the efficiency curve from half load to one-quarter overload approaches a straight line. Data of value to electroplaters are also given.

BUSINESS NOTES.

MOHAWK ELECTRIC COMPANY, Newark, N. J., will open a Pacific Coast branch in San Francisco, Cal. Mr. H. V. Mooney, who has been associated with the company for the past two years, will have charge of the establishment of the new branch. A complete stock of Rollinson specialties and a repair and testing department will be maintained in San Francisco, whence all Western orders will be shipped. The Mohawk Electric Company was formerly located in Albany, N. Y., and manufactures rectifying sets, toy transformers, lamp-testing watt indicators, etc.

AUTOMOBILE ELECTRIC LIGHTING.—The Ward-Leonard Electric Company, of Bronxville, N. Y., reports great progress in the manufacture and sale of the Ward-Leonard automatic dynamo lighting system for automobiles. It has recently received an order from the Cole Motor Car Company, of Indianapolis, to equip all of the cars of that company for 1912 with this dynamo lighting system. Agency arrangements for the sale and installation of Ward-Leonard automatic generator lighting systems have been completed with the following firms: Wheeler-Green Electric Company, Rochester; Morton Havens, Jr., Albany; Conduit Electric Company, Syracuse; Johnson-Fay Electric Company, Buffalo; Baldwin-Stewart Electric Company, Hartford; Auto Appliance Company, Cleveland, and United Electric Company, Baltimore.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 12, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,011,141. ILLUSTRATIVE TELEGRAPHY; N. S. Amstutz, Cleveland, Ohio. App. filed Aug. 30, 1901. Transmitting and reproducing sketches, etc., by varying the rate of propagation of electrical impulses.

1,011,160. MERCURY RECTIFIER; F. P. Coffin, Schenectady, N. Y. App. filed March 3, 1909. Metal envelope with mechanical details.

1,011,164. INSULATOR; S. S. Cornelius, McDowell, Mo. App. filed June 8, 1911. Metal bracket and porcelain block for line wires.

1,011,165. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed June 21, 1911. Generator and storage-battery system.

1,011,166. ELECTRIC INCANDESCENT LAMP AND HOLDER; C. Damey, London, England. App. filed Sept. 22, 1910. A lock for preventing the removal of a lamp from the socket.

1,011,168. TELEPHONE SYSTEM; W. W. Dean, Elyria, Ohio. App. filed Nov. 2, 1908. Local battery party line with tuned vibrators.

1,011,169. IGNITION DEVICE; W. W. Dean, Elyria, Ohio. App. filed Oct. 14, 1910. Electromagnetic vibrator and system.

1,011,175. COMBINED ELECTRIC DOORBELL AND FIRE-ALARM; C. E. Egan, Lafollette, Tenn. App. filed Oct. 26, 1910. Push-button switch and heat-operated diaphragm switch.

1,011,179. SHADOWER OR INSULATOR; F. A. Feldkamp, Vailsburg, N. J. App. filed April 1, 1911. A sheet or plate of celluloid, vulcanite, etc., with holes surrounded by flanges for electro-depositing of structures such as automobile radiator plates.

1,011,203. PROCESS FOR PICKLING ALUMINUM AND ITS ALLOYS PRIOR TO GALVANIZING OR COATING THE SAME WITH OTHER METALS; S. Jahn, Charlottenburg, Germany. App. filed June 16, 1910. Heated bath containing HCl and glycerine.

1,011,210. CABLE RELAY APPARATUS; I. Kitsee, Philadelphia, Pa. App. filed Dec. 4, 1908. For transposing the positive and negative impulses of a cable system to the dot and dash system.

1,011,212. ALTERNATING-CURRENT CONTROLLER; D. Larson, Yonkers, N. Y. App. filed Oct. 2, 1905. Electromagnetic switch.

1,011,232. ELECTRICAL SAFETY FUSE; G. Müller, Schwabisch-Gmünd, Germany. App. filed Nov. 29, 1910. Central-bolt plug fuse.

1,011,240. ELECTRICAL CONTROLLING APPARATUS; O. H. and A. F. Pieper, Rochester, N. Y. App. filed March 6, 1911. Dental motor switch.

1,011,258. GALVANIC BATTERY; E. C. Smith and E. L. Marshall, Fremont, Ohio. App. filed Aug. 7, 1909. Caustic electrolyte; closed-circuit cell.

1,011,267. MOTOR CONTROL; A. Sundh, Yonkers, N. Y. App. filed March 13, 1908. Manual, mechanical and pneumatic elevator motor control.

1,011,268. MOTOR CONTROL; A. Sundh, Yonkers, N. Y. App. filed Dec. 17, 1908. Push-button-controlled electric elevators, etc.

1,011,291. RAILWAY SIGNALING SYSTEM; H. A. Wallace, New York, N. Y. App. filed June 15, 1911. "Home and distant" system with "block" sections.

1,011,328. THERMOSTAT DAMPER REGULATOR; R. E. Dewey, Grand Rapids, Mich. App. filed Nov. 27, 1909. Improvement on Patent No. 926,391.

1,011,357. ELECTRIC LIGHTER FOR CIGARS; T. P. Moody, Chicago, Ill. App. filed Oct. 27, 1910. Double-spark vapor ignition.

1,011,376. RHEOSTAT; G. A. Scheeffer, Indianapolis, Ind. App. filed Jan. 14, 1910. A rod with insulated resistance coils.

1,011,396. METHOD OF AND APPARATUS FOR THE TREATMENT OF LAMP FILAMENTS; W. G. Abbott, Jr., Schenectady, N. Y. App. filed Oct. 9, 1908. Filaments are fed progressively through a heated gas-treating receptacle.

1,011,402. AUTOMATIC ELECTRIC TRAIN-LINE COUPLING; W. L. Bliss, Brooklyn, N. Y. App. filed Jan. 6, 1905. A longitudinally movable member is supported on a pivoted member and carries a movable coupling member.

1,011,405. TELEPHONE DESK SET; P. C. Burns, Chicago, Ill. App. filed March 9, 1905. Lazy-tongs extension bracket.

1,011,413. PROCESS OF ELECTRICALLY DECOMPOSING FLUIDS; W. H. Cone, Chicago, Ill. App. filed March 16, 1910. Electric current is passed in the direction of flow of the liquid and the products withdrawn at different points; NaCl, etc.

1,011,439. MAGNET TERMINAL; W. Kaisling, Chicago, Ill. App. filed March 2, 1906. Projecting split tube.

1,011,459. PROCESS FOR EXTRACTING METALS FROM THEIR ORES; H. S. McKay, Riverside, Cal. App. filed Jan. 20, 1910. Electrochemical process, particularly for copper ores.

1,011,462. TROLLEY; W. E. Marshall, Logansport, Ind. App. filed March 8, 1911. Oscillating frame for holding the wheel.

1,011,485. ELECTRIC BATTERY; G. Pfleiderer, Gross-Lichterfelde, Germany. App. filed June 21, 1911. Dry battery.

1,011,493. LIGHTNING ARRESTER; C. Robinson, Schenectady, N. Y. App. filed June 19, 1907. A series of oil-immersed carbon balls resting in metal troughs.

1,011,503. ELECTRIC OZONIZER; S. Shepherd, Ottawa, Canada. App. filed April 18, 1910. The layers are separated by corrugated metal gauze.

1,011,526. VIBRATING RECTIFIER; E. Thomson, Swampscott, Mass. App. filed July 1, 1911. A body of mercury free to vibrate in the air-gap of a magnet.

1,011,527. ELECTRIC SIGNAL SYSTEM; W. V. Turner, Edgewood, Pa. App. filed Feb. 23, 1907. Single-wire annunciator for railway trains.

1,011,538. LIGHTNING ARRESTER; E. Weintraub, Lynn, Mass. App. filed Sept. 5, 1911. A vapor device with conductive deionizing bodies in the path of the arc.

1,011,544. SOCKET FOR INCANDESCENT ELECTRIC LAMPS; H. C. Wirt, Plymouth, Mass. App. filed Oct. 12, 1910. A groove for holding the lining in a cap.

1,011,546. CIRCUIT-CONTROLLING DEVICE; J. E. Woodbridge, San Francisco, Cal. App. filed May 20, 1910. A circuit-breaker and switch in series with an alarm device.

1,011,554. RAILWAY-SWITCH INSTRUMENT; C. O. Anderson, Omaha, Neb. App. filed Feb. 14, 1911. Indicating and controlling device operated by a railroad switch.

1,011,559. CARBON ELECTRODE FOR GALVANIC ELEMENTS; S. Benko, Budapest, Austria-Hungary. App. filed June 17, 1909. A carbon disk is impregnated with metal at its periphery.

1,011,574. ELECTRIC-HEATED GLOVE; A. L. Carron, Binghamton, N. Y. App. filed Sept. 9, 1911. Coils of wire in the fingers with contacts to engage conductors on a steering wheel.

1,011,600. LINE-TAPPING DEVICE FOR TELEPHONE AND OTHER CIRCUITS; C. B. Forrest, Middleport, Ohio. App. filed March 19, 1910. A pole with contact clips.

1,011,602. AUTOMATIC BLOCK-SIGNAL SYSTEM; W. E. Foster, Chicago, Ill. App. filed July 22, 1910. Relay construction and circuits.

1,011,607. SURGICAL IMPLEMENT; J. A. Fulton, Astoria, Ore. App. filed Oct. 22, 1909. A tube for internal heat treatment and an external temperature indicator.

1,011,616. ELECTRIC INSTRUMENTS; E. A. Halbleib, Rochester, N. Y. App. filed Dec. 16, 1910. Electric valve having an electromagnet and armature and a polarizing fixed magnet.

1,011,639. ELECTRIC SWITCH; T. E. Murray and W. T. Dempsey, New York, N. Y. App. filed July 1, 1911. Gang-plug oil switch.

1,011,652. STRAIN INSULATOR; L. Steinberger, New York, N. Y. App. filed May 25, 1910. A metal tube with insulated anchors.

1,011,662. SWITCHBOARD CONSTRUCTION FOR ALTERNATING-CURRENT CONTROLLERS; A. Sundh, Yonkers, N. Y. App. filed May 27, 1908. The magnet is supported on rubber to absorb vibration and avoid humming.

1,011,663. ALTERNATING-CURRENT ELECTROCHEMICAL CONTROLLER; A. Sundh, Yonkers, N. Y. App filed Aug. 11, 1908. A series of switches are operated by cams on a power-driven shaft.

1,011,710. TERMINAL CLIP FOR ELECTRIC BATTERIES; C. E. Avery, Jersey City, N. J. App. filed July 17, 1911. Bent spring wire with securing eye.

1,011,723. TROLLEY WHEEL AND FINDER; B. R. Beach, Fieldsboro, N. J. App. filed March 21, 1911. Spirally grooved roller.

1,011,732. CURRENT-LIMITING DEVICE; D. Broido, Berlin, Germany. App. filed May 25, 1908. Make-and-break type for use where electricity is sold on a flat-rate basis.

1,011,741. DEVICE FOR GROUNDING TROLLEY CORDS; F. E. Case, Schenectady, N. Y. App. filed Sept. 25, 1908. The cord passes through a permanently grounded guide laterally movable on the car roof.

1,011,754. SNAP SWITCH; A. S. Cubitt, Pittsfield, Mass. App. filed March 18, 1911. Reciprocating snap action with bow spring.

1,011,756. DEVICE FOR AUTOMATICALLY OPENING AND CLOSING VALVES; G. Dalen, Stockholm, Sweden. App. filed July 20, 1907. Light buoy, etc.; gas valve is closed by action of daylight.

1,011,757. MOTOR-CONTROLLING DEVICE; M. W. Day, Schenectady, N. Y. App. filed July 16, 1909. Starting mechanism, speed-regulating mechanism and an auxiliary short-circuiting switch.

1,011,758. SAFETY DEVICE FOR ELEVATORS; J. F. Dean, Scranton, Pa. App. filed April 8, 1911. Controlling switches are held closed by the doors.

1,011,769. INDUCTION FURNACE; E. F. Gehrkens, Pittsfield, Mass. App. filed July 14, 1910. The wall of the furnace is part of the secondary.

1,011,771. SUPPORTING FRAME FOR INCANDESCENT LAMPS WITH METAL FILAMENTS; L. Glaser, Berlin, Germany. App. filed March 13, 1907. Encircling protecting loops.

1,011,774. CENTRIFUGAL SWITCH; C. H. Haddrell, Lynn, Mass. App. filed May 14, 1910. For small single-phase induction motors.

1,011,777. WIRELESS TELEGRAPHY; J. Harden, Schenectady, N. Y. App. filed Oct. 10, 1904. Sending apparatus and mercury spark-gap device.

1,011,778. REVERSING SWITCH FOR ELECTRIC MOTORS WITH OPPOSITELY ROTATING MAGNETS AND ARMATURES; V. Harborn, Friedenau, Germany. App. filed March 11, 1911. For road wheels of motor vehicles.

1,011,783. INDUCTION MOTOR; R. E. Hellmund, Hinsdale, Ill. App. filed June 22, 1907. A plurality of sets of windings with a switch for producing different speeds.

1,011,784. CIRCUIT-BREAKER; E. M. Hewlett and C. H. Hill, N. Y. App. filed March 28, 1905. A plurality of switches with a common tripping device.

1,011,785. CIRCUIT-BREAKER; C. H. Hill, Schenectady, N. Y. App. filed Nov. 9, 1905. Hand-setting device with a lock-out.

1,011,791. INSULATION OF WINDINGS IN ELECTRICAL APPARATUS; G. Honold, Stuttgart, Germany. App. filed Oct. 18, 1909. Double layers for the armatures of magneto ignition devices.

1,011,801. SIGNAL FOR RAILWAY SWITCHES; A. H. Johnson, Epsom, England. App. filed June 9, 1911. Mechanical details of a "point" signal device.

1,011,809. ELECTRICAL WATER-HEATER; L. Katz, San Francisco, Cal. App. filed Feb. 8, 1911. The water runs through a chamber containing the resistance coils.

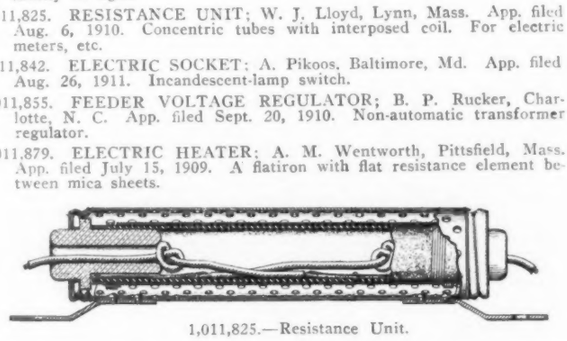
1,011,824. SELENIUM CELL; O. Linder and J. B. Replogle, Chicago, Ill. App. filed Jan. 26, 1911. A resistance unit affected by the intensity of light.

1,011,825. RESISTANCE UNIT; W. J. Lloyd, Lynn, Mass. App. filed Aug. 6, 1910. Concentric tubes with interposed coil. For electric meters, etc.

1,011,842. ELECTRIC SOCKET; A. Pikoos, Baltimore, Md. App. filed Aug. 26, 1911. Incandescent-lamp switch.

1,011,855. FEEDER VOLTAGE REGULATOR; B. P. Rucker, Charlotte, N. C. App. filed Sept. 20, 1910. Non-automatic transformer regulator.

1,011,879. ELECTRIC HEATER; A. M. Wentworth, Pittsfield, Mass. App. filed July 15, 1909. A flatiron with flat resistance element between mica sheets.



1,011,825.—Resistance Unit.

1,011,890. INCANDESCENT ELECTRIC LAMP; J. L. Rooney, New York, N. Y. App. filed Jan. 5, 1910. Multiple-filament "turndown" effected by partial rotation of the lamp.

PATENTS DELAYED IN RECEIPT.

1,002,563 (Sept. 5). SENDER FOR AUTOMATIC TELEPHONE SYSTEMS; E. E. Clement, Washington, D. C. App. filed Nov. 11, 1905. Special finger holds for the operating member.

1,003,337 (Sept. 12). METHOD OF RELAYING ELECTRICAL CURRENTS; E. E. Clement, Washington, D. C. App. filed June 16, 1898. To eliminate the "time constant" in telegraph and telephone work.

1,008,809 (Nov. 14). INCANDESCENT LAMP WITH DRAWN-METAL-WIRE FILAMENT; K. Farkas, Glen Ridge, N. J. App. filed June 23, 1911. The filament is divided into sections to avoid expansion and contraction difficulties.